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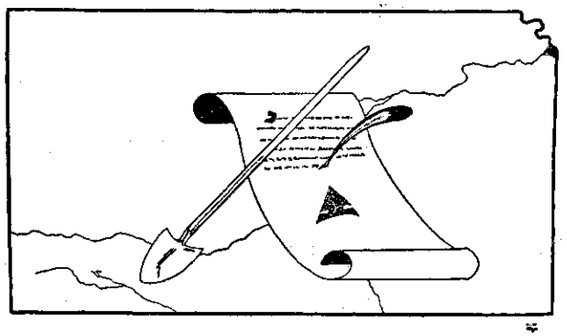

COAL-OIL CANYON

(14LO1)

Report on Preliminary Investigations

BY

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Eugene R. Craine
Editor

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ACKNOWLEDGEMENTS

Probably few archeological enterprises have owed so much to so many people. With little equipment, less knowledge, no experience and meagre finances we literally started from scratch and without the help we have received little could have been accomplished.

Whatever scientific value our work may have is due in large part to George Metcalf and Dr. Waldo R. Wedel, Division of Archeology, United States National Museum. They examined and identified artifact samples from the site and provided most of the archeological literature from which we learned methods, terms, techniques, etc., and were able to make other identifications and comparisons. In addition, Mr. Metcalf has kept up a steady correspondence of practical advice and, in 1957, spent much of his vacation working at the site. The help these men provided is a measure not only of their generosity but of their interest in Plains archeology.

Cooperation from the land owner is an essential part of any archeological investigation and we were also very fortunate in this matter. Mrs. R. F. Surratt, of Panhandle, Texas, owner of the ranch on which the site is located and Oliver Bender, ranch foreman, readily gave us exclusive permission to dig. "Pete" and Leonard Johanneson, of Lyons, Kansas, who own the quarter-section to the south, told us to dig "anywhere, anytime" on their land even, they insisted, without regard to growing crops. Here was an example of generous cooperation that is rarely encountered.

Those who manned shovel, trowel and screen and took turns furnishing transportation were Jerome Bussen, Kenneth Bohm, Richard Bussen and myself, all of Wallace. James Allaman also did considerable work at the site before entering the Army in 1957. Jerome Bussen in particular has been the mainstay of the project, furnishing not only a large share of the equipment, transportation and work but also the avid curiosity, scientific inclination and perseverance so necessary in archeology.

The topographic maps were made possible through the generosity of Duane Deckman, of Sharon Springs, who loaned us a transit, and of Nick Bussen, of Wallace, who instructed us in its use and initiated us into the art of topographic surveying. For the hundreds of mathematical calculations involved in the process Bob Clark, manager of the Clark and Son Elevator of Wallace, loaned me the office calculator. Bob also helped with the photography and in preparing the manuscript. Joe DeTilla, of Sharon Springs, loaned me his copy of *The Geology of Wallace County*. This report

has been out of print for many years and would not otherwise have been available for ready reference.

Lawrence Bussen, proprietor of the Wallace Garage, made and repaired several items of equipment for us free of charge. Raymond Bussen has been a frequent visitor at the site, often lending a hand with the work and during the surveying served as rod man for several days in rather disagreeable weather.

And a word should be said for the long-suffering mothers of the crew members who week after week packed Sunday dinner into lunchboxes, who never knew when to expect us back in the evenings, and whose tables and sinks were often covered with dirty bones and artifacts.

Altogether, a complete list of the people who loaned us equipment, gave us information and helped in various ways would be a roster of nearly half the population around Wallace. They range from those with a genuine interest in archeology to some who may have had doubts as to our mental stability but all were willing to help, and for all the assistance we have received we are sincerely grateful.

COAL-OIL CANYON

(14L01)

REPORT ON PRELIMINARY INVESTIGATIONS

By

Peter W. Bowman

INTRODUCTION

Site 14L01, previously unknown even to local collectors, was discovered on 30 December 1955, by Jerome Bussen and Kenneth Bohm of Wallace, Kansas, when the latter found a potsherd in the face of a cutbank. Cultural material was very scarce on the surface but a little digging and screening next day produced several more sherds, 16 complete or fragmentary arrowpoints and large amounts of broken bone, flint chips, etc. This convinced them that the site was of importance and that it should be reported. Samples of the artifacts were sent to the Division of Archeology, U. S. National Museum, and the find was reported to the Kansas Anthropological Association. On 4 March 1956, a party from the KAA headed by Dr. E. R. Craine, visited the site, surveying and collecting samples. Very little evidence of aboriginal occupation was to be found on the surface, so Dr. Craine recommended that we put down a series of test-pits. Permission to dig was obtained from the landowners and the project started.

The work was done mostly on week-ends and holidays the year around (weather permitting) by local amateurs, the work force varying from 1 to 5. The soil was often hard, invariably rocky, and in places interwoven with bush roots, making digging exasperatingly difficult. Progress, therefore, has been painfully slow.

The evidence indicates that the site was occupied by several different groups over a considerable period of time but, since most of the cultural material found came from small random tests, often in areas showing signs of considerable erosion, no attempt at correlation can be made as yet. Much of the ceramic material can be assigned with some confidence on typological grounds to aboriginal complexes known from other sites. But at present most of the material has little more value than surface finds and perhaps should be considered as such. Systematic excavation of the Areas which testing showed to be most promising has begun and it is hoped that this work will place some of the present material in its proper sequential context as well as providing a larger artifact inventory and additional information for a more valuable report. But that happy time is probably several years in the future

and it was thought that a report briefly describing the site locality, the artifacts and the conditions under which they were found might have some value at present, particularly since the site is in an archeologically little-known region.

GEOLOGY

On its course through eastern Wallace and western Logan Counties the Smoky Hill River has formed what may be called a flanking pediment (Frye and Leonard 1952: 25-7; Frye 1954: 88-9) in rocks of late Cretaceous and Pliocene age. To the north of the river, where the Tertiary deposits have mostly been removed by erosion and the Cretaceous shales are mantled with late Pleistocene wind-laid silts, the topography is gently to moderately rolling. South of the floodplain, however, the terrain slopes more or less uniformly upward at an average gradient of perhaps one hundred feet per mile for two to three miles, culminating in "pediment-head" bluffs of cemented sandstone — the "mortar-beds" of the Ogallala formation (Pliocene) — which border the flat loess-covered uplands to the south.

The slope, or flanking pediment, has been dissected at intervals of one-half to one and one-half miles by draws trending for the most part in a northerly to north-easterly direction. Where they join the river floodplain these draws are relatively broad and shallow but their gradients are considerably less than that of the pediment surface and they become progressively deeper and narrower to the south. They have markedly dissected the mortar-bed bluffs for distances up to a mile or more back from the pediment-head, cutting completely through the Ogallala and well into the underlying Pierre shale, forming in places a picturesque maze of canyons, often narrow and straight-walled.

Coal-oil Canyon, which heads partly in Wallace County but lies mostly in Logan County, is one of the largest of these draws. The canyon's west branch, on which 14L01 is located, is rimmed with a discontinuous ledge of Ogallala mortar-beds which in places has a vertical face up to twenty-nine feet in height. Short lateral feeders or "side-pockets" occur at varying intervals around the canyon's perimeter giving it a highly irregular outline. The steeply-sloping sides of the canyon are covered for the most part with talus material and slumped-off blocks from the mortar-bed ledge, although large exposures of the clay and shale which underlie the Ogallala are numerous. The floor of the canyon, and that of the side-pockets, is covered with a thick deposit of alluvium in which discontinuous gullies and channel-pools have formed.

The site locality, at the head of one of the side-pockets, presents a rather confusing picture geologically, at least to the archeologist, whose concern is with microtopography and recent and highly detailed geomorphology.

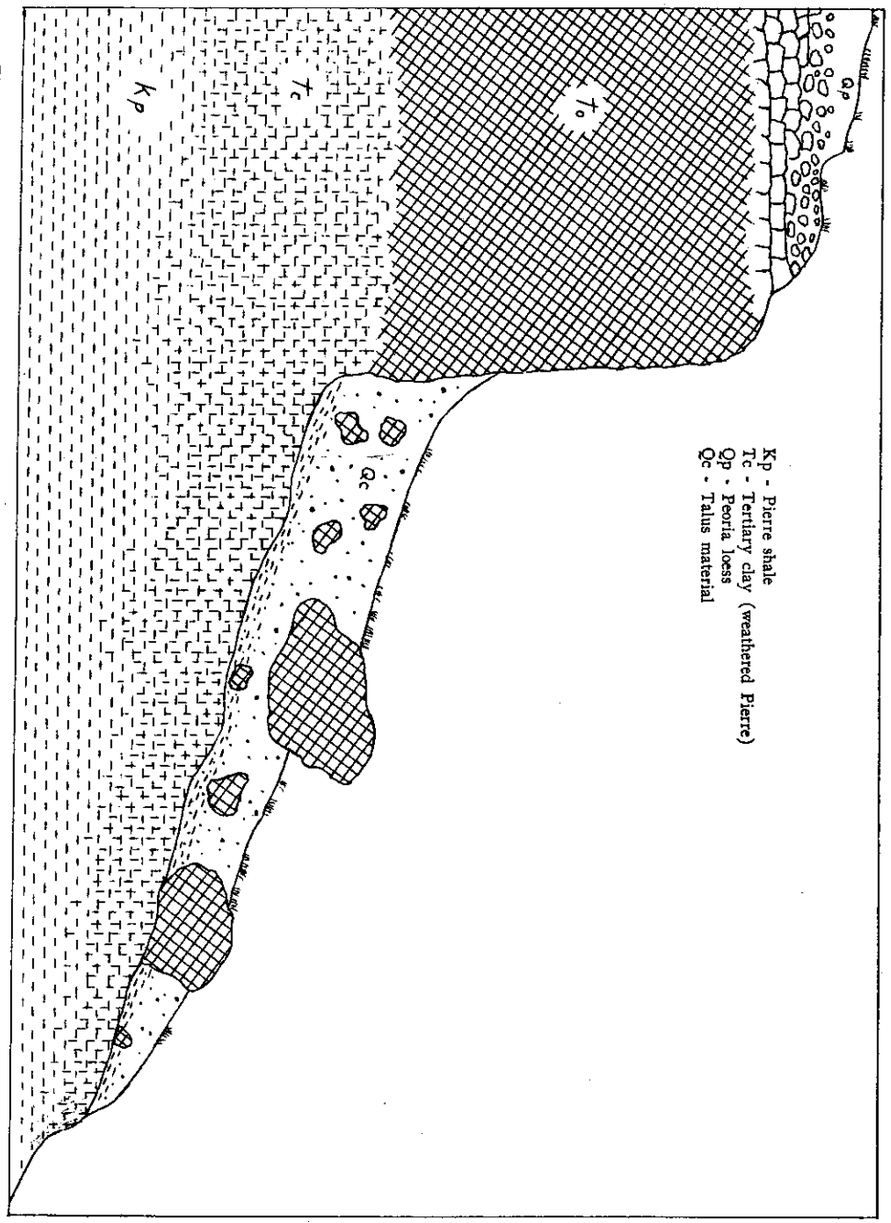


Figure 2. Generalized geologic section, vicinity of 14L01. No scale.

As the map (Fig. 1, pages 24 and 25) and photographs (Pl. 1) show, the terrain is rugged and extremely rocky. In the site vicinity the side-pocket forks into two deep and narrow gullies which culminate at the mortar-bed ledge, with an even deeper and narrower one to the northwest. The talus slopes at the foot of the ledge, in which most of the cultural material has been found, are deposits of sandy, rocky soil with depths varying from twelve feet to a thin feather-edge and are littered throughout with fragments of mortar-bed ranging from gravel-size to boulders weighing many tons. Erosion and redeposition by sheet and rill wash around these boulders, plus deposition of material weathered from the ledge, some loess from above the ledge and probably a certain amount of wind-laid dust, have resulted in an extremely complex stratification. A generalized section of the major geological strata is shown in Fig. 2.

The oldest bed outcropping in the site vicinity is late Cretaceous in age, the Upper Sharon Springs shale member (Elias 1931: 58-77) of the Pierre formation (Kp, Fig. 2). The shale is fissile, somewhat unctuous, medium grey to dark grey in color and contains thin streaks and partings of limonite, bentonite and gypsum. Locally some zones contain considerable crystalline gypsum in concentrations of small, flaky crystals and (rarely) large rosettes. Moderately large rounded concretions of silty limestone, both concentric and septarian, are fairly abundant in small areas. These concretions, particularly the septarian, occasionally contain considerable amounts of ferric oxide, in both hydrous (limonite) and anhydrous (red, earthy hematite) forms. These ochers vary considerably in color and purity but would undoubtedly have been a valuable source of pigment for primitive peoples. Pure yellow ocher is relatively abundant but the reddest material is usually shot through with crystals of gypsum, barite or calcite or is extremely hard. The ochers intergrade by color, and while soft, bright red ocher is rare, red-orange, orange and yellow-orange material soft enough to be easily ground is fairly common.

In the site area, and for several miles to the east and west, the upper several feet of the Pierre is locally altered by weathering to a clay differing markedly in appearance from the dull grey shale. In color this clay varies from light cream to light blue-grey and light greenish-blue with streaks, partings and mottlings of bright red and yellow. It differs from the unweathered shale also in being decidely more unctuous and is extremely plastic and sticky when wet, making a very "fat" pottery clay. This material is so distinctly different in appearance from typical Pierre shale that at first we were of the opinion that it might be analogous to the bentonitic "Woodhouse clays" reported by Elias (1931: 153-8) as occurring near the base of the Ogallala in northwestern Wallace County. Two samples of the

clay, one from the site vicinity and one from a similar exposure seven miles west of the site, were sent to the State Geological Survey of Kansas. Dr. Ada Swineford, petrographer for the Survey, reported on them as follows: "I have run X-ray diffraction patterns on your two clay samples, and they seem to be identical in mineral composition. Both consist predominately of montmorillonite, but they also contain considerable quantities of quartz and traces of the clay minerals illite and kaolinite. This composition is more characteristic of Pierre shale than of good bentonite." Elias describes the "peculiar weathering" of the Upper Sharon Springs shale member "which tinges these beds bright greenish-yellow to straw colors." (Elias 1931:63). Also, the fact that we occasionally find in the clay fragments of concretions similar to those occurring in the shale indicates that the clay is a product of weathering of the Pierre.

This bed has been of importance during excavation of the site. For one thing, since it underlies much of the site, it serves as an archeological "bedrock": when a test or trench is dug to the clay it can confidently be considered as completed. Also, there is reason to believe that it was used to some extent as pottery clay by most of the occupations, though in experiments I have made it seems to have an almost prohibitively high drying-shrinkage and tends to pop and shatter badly during firing. Perhaps of most importance is the fact that it does not disintegrate easily but erodes into small angular bits. These particles show up quite plainly when mixed with the rocky soil of the talus slopes and it is hoped that they will be of value in tracing and correlating otherwise featureless strata.

For convenience it seems necessary to distinguish between this material and the unweathered shale. Since it most probably acquired its present appearance during post-Cretaceous and pre-Ogallala time I have decided to refer to it in this paper as the Tertiary clay (Tc, Fig. 2) even though geologically it is included in the Pierre formation.

At the base of the present ledge there seems to be a reasonably sharp contact between the Tertiary clay and the pinkish grit of the basal Ogallala but in some tests on the talus slopes a zone often several feet thick has been found containing a mixture of materials from both beds. This zone, consisting of lumps and small particles of clay mixed with or surrounded by pinkish grit with occasional large accumulations of calcium carbonate containing sand and bits of clay, seems to occur on steep pre-Ogallala slopes of the clay. It contains no humous material or fragments of the upper mortar-beds and probably represents the time when the bare clay slope was eroding and mixing clay with the Ogallala sediments building up below. For convenience in the field we have come to call this zone "proto-Ogallala." Where it occurs (and can be positively identified) it also serves as an archeological bedrock.

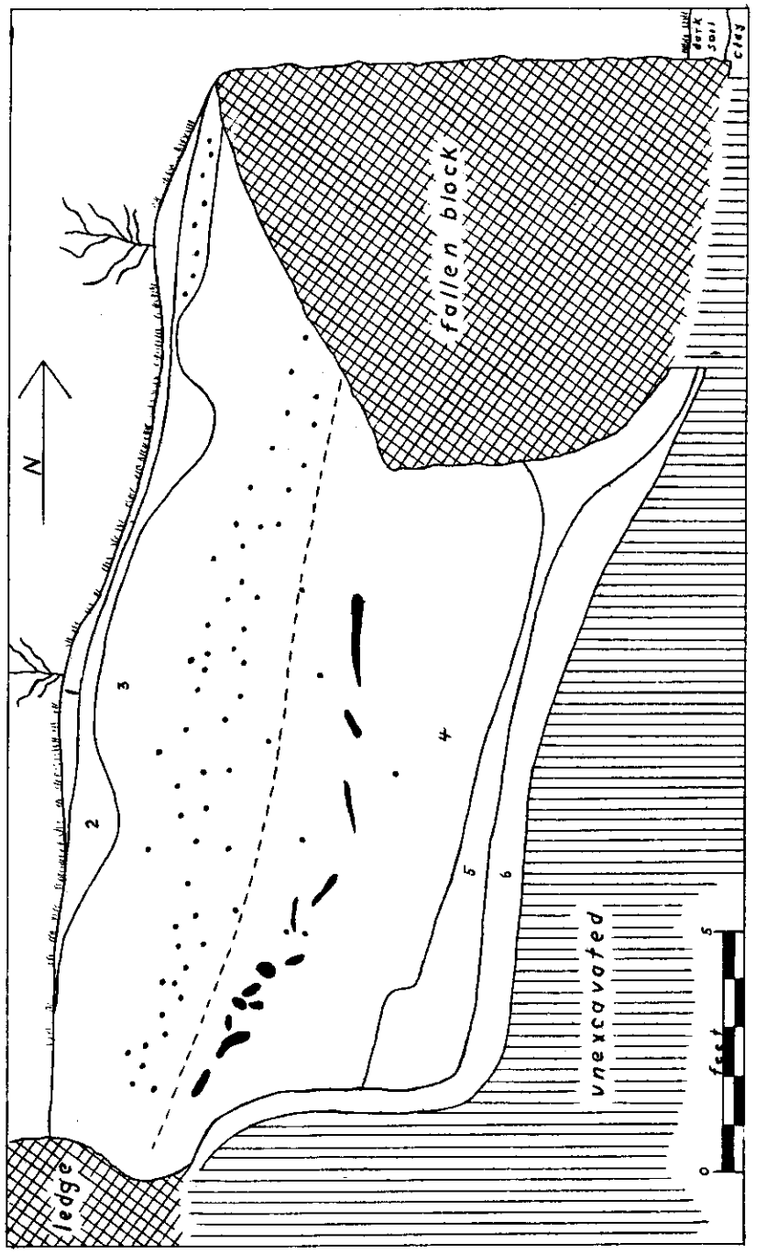


Figure 3. Profile through Area 1, 14L01. Dots indicate location of cultural material. Dark spots are patches of dirty pulverized charcoal.

1 - Eolian silt.
2 - Dark rocky soil.
3 - Greyish rocky soil.
4 - Tan rocky soil-grades upward into 3.
5 - Pinkish grit and gravel.
6 - Tertiary clay.

The Ogallala at Coal-oil Canyon (To, Fig. 2) is relatively thin and probably only the Kimball member (Frye, Leonard and Swineford 1956: 60-4) is represented. It consists mostly of one mortar-bed zone ten to twenty-five feet thick resting unconformably on Pierre shale. In the immediate site vicinity the bed is composed mostly of silt and very fine sand, though considerable gravel is present and pebbles up to several inches in size also occur. The unsorted clastic material is unevenly and irregularly cemented by calcium carbonate. In places the ledge is rather soft and friable and weathers comparatively fast; in others the rock is very tough and can be broken with a sledge only with great difficulty. Some variation in hardness often occurs within the ledge, both laterally and vertically, in the space of a few yards. In general, the lower few feet of the present ledge is poorly consolidated and runoff water converging into the gullies from above the ledge has eroded this softer material from beneath the harder zone leaving shallow overhangs or caves at the head of both gullies.

Remnants of a bed of moderately hard white limestone occur immediately above the mortar-bed zone. This material has a rather platy structure and contains occasional grains of sand. Also present are small scattered accumulations of white waxy chert and (more rarely) bluish-white translucent opal-like material. Probably the upper part of this bed has been removed by erosion; at present it is only a few feet thick and in most places much of this thickness is in the form of "float" — large cobbles with a "dripstone" undersurface intermixed with loess. There are a few cobbles of the "Algal limestone" which is considered to be the caprock of the Ogallala (Elias 1931: 136-42) present in the upper part of the float.

The uplands to the south and west of the canyon are mantled with a massive bed of loess, probably the Peoria formation (Qp, Fig. 2) of the Sanborn group.

The most important bed archeologically (and the most confusing geologically) is the layer of rocky boulder-strewn soil overlaying the Tertiary clay below the mortar-bed ledge (Qc, Fig. 2). Most of the cultural material found to date has come from this bed. It is composed chiefly of silt but contains generous amounts of unsorted sand and gravel and occasional pebbles. Also mixed throughout are fragments of mortar-bed ranging from gravel-size through pebbles, cobbles and boulders to huge blocks. The contact between this soil and the underlying clay is usually marked by a zone of varying thickness composed of pinkish grit (silty sand and gravel) mixed with lumps and particles of clay. In a few cases it has been difficult to determine if this material is undisturbed "proto-Ogallala" or a residue left when the mortar-bed was eroded away. The main criterion used in distinguishing between the two

is the presence of humous material and/or fragments of the upper mortar-beds in the latter. Next above this there is usually found a layer of tan to buff gritty material, very rocky and highly calcareous. This material contains pockets of humous soil and in general becomes gradually more grey from bottom upward — probably due to increasing amounts of humus — grading into a darker, more silty and less rocky soil. In some Areas, at about this stratigraphic level, layers of very dark, loose silty soil have been found. These vary in thickness from a feather-edge to two feet or more, usually contain less sand and gravel and often fewer but larger fragments of mortar-bed. Below, between and above these layers the soil is lighter in color, usually more compact and contains more sand and gravel. The more level and protected areas of the site have thin discontinuous patches of fine dark silt on the surface. These patches are rarely more than a few inches thick and pinch out laterally. They contain the usual fragments of mortar-bed but little sand or gravel. Undoubtedly they are "blowdirt," probably representing the dust storms of the last several decades.

There can be little doubt that most of this soil is talus material, a product of disintegration of the mortar-bed ledge. The tan rocky material in the lower part appears identical in color and composition with the mortar-bed and the darker zones above differ mainly in color, which is most probably due to weathering and humus provided by decayed vegetation. In general this soil seems very similar to the Clark Stony Loam as described by Coffey and Rice (1912) from the type locality in Clark and Meade Counties, Kansas:

> Description (in part) — The usual soil is a light to dark brown silt loam, underlain by a lighter colored silt loam, containing more or less soft white calcareous rock. There may be limestone fragments of all shapes and sizes interspersed through both soil and subsoil or scattered over the surface. The topsoil may in places be as deep as 18 inches, but more often it is not over 6 inches. The deep-brown well-weathered soil is found only in the level less-eroded areas. Where the country is more eroded, the calcareous rock outcrops and appears as blocks and ledges. By erosion or by the shrinking of the underlying strata, blocks and fragments of the rock have fallen and obstruct the hillsides.
>
> Origin — The relatively small areas of the soil are formed by weathering from the calcareous rocks of the Mortar Beds and the different depths of soil represent the length of time that weathering of the rock has gone on undisturbed. Over a large part of the area of this type the soil has been washed from the hillsides as fast as it accumulates from the decomposition of the rock (Coffey and Rice 1912: 35-6).

The very dark silty layers previously mentioned are something of a problem. The bed does not seem sufficiently old for one, much less two or more, thick black soils to have developed through the slow soil-building processes of decay and weathering. Some of the silt may be topsoil from above the ledge redeposited by sheetwash. But nearly all the drainage from the uplands converges into the gullies (see map, Fig. 1), so redeposition of silt over the ledge onto the talus slope would seem to be comparatively negligible. At present it seems more reasonable to assume that these dark layers are composed in large part of wind-blown topsoil, deposited under severe drouth conditions. If a method could be found to accurately determine the origin of the silty material in these layers and sufficiently diagnostic cultural material recovered to date them some valuable data on prehistoric High Plains climatic conditions might be obtained.

The above description of the talus slope strata is in fact highly generalized and simplified. Deposition, erosion and redeposition around the blocks of rock-fall plus differential weathering of the ledge, creep and slumping along the gully edges, etc., have combined to produce a stratification that at best is complex and at worst completely chaotic. The tan rocky material, for instance, was encountered at a depth of over eight feet in one test but appears on the surface in other places. Material on the surface in the site vicinity varies in age from sixty million years to some that came in with the last heavy rain. A few tests have indicated a fairly distinct and undisturbed stratigraphy; in others the strata are badly disturbed or illegible.

LOCAL ENVIRONMENT

Site 14L01, located in western Logan County, Kansas, lies near the eastern border of the High Plains section in the Great Plains province. Climate, flora and fauna of the site locality are typical of the High Plains and have been often and adequately described, e.g. Webb 1931, Wedel 1941. But it should be noted that the biota of Wallace and Logan Counties has undergone considerable change during the ninety years of white occupation and at present bears small resemblance to that of pre-white times. In 1870 a report compiled by Acting Assistant Surgeon M. M. Shearer, U. S. Army, for the Surgeon General's Office listed the following wild animals in the vicinity of Fort Wallace (located on Smoky Hill River in what is now eastern Wallace County): prong-horned antelope, black-tailed deer, elk, buffalo, wild horse, jumping hare, muskrat, rabbit and jack rabbit, beaver, otter, wolves and weasel. Although this list cannot be considered complete it serves as an example. Of the animals mentioned only the rabbit can be

said to have held his ground against the coming of the white man. The others were thinned out, driven off or exterminated.

The native flora received similar treatment. The short thick buffalo grass which formerly characterized the region has largely been plowed up and today survives mostly on the roughest terrain. Extensive cultivation also introduced new vegetation into the area, such as pigweed, fireweed, various thistles, etc. The upland areas of the High Plains have undoubtedly been treeless for many thousands of years (Wedel 1953: 500) but reports of the early explorers indicate that timber grew in the major stream valleys. Much of the timber in Wallace County was cut out by the early settlers but as access to better fuel and building materials came with improved transportation this practice was gradually abandoned. Today, the Smoky Hill valley supports a narrow but practically continuous stand of cottonwood and willow trees through Wallace and Logan Counties and discontinuous stands occur in the valleys of many of the smaller streams.

Climate in the site area is semi-arid, characterized by abundant sunshine, light to moderate precipitation, low average humidity and considerable wind. Temperatures are apt to be extreme; official readings have varied from -24 degrees to 116 degrees. Average precipitation in the site locality is in the neighborhood of 17 inches annually but is highly variable. Records in Logan County show a variation in annual precipitation from 8.84 inches at Russel Springs in 1916 to 34.63 inches at Oakley in 1941. The average at Oakley (in the northeast corner of the county) is 18.97 inches. Average annual precipitation in Wallace County since 1870 is 16.44 inches. It has varied from 7.45 inches at Wallace in 1873 to 31.28 inches at Sharon Springs in 1949. Over three-fourths of the annual precipitation falls during the spring and summer, usually in the form of thundershowers which are often local and occasionally quite severe. Probably the worst in modern times was the cloudburst which occured about thirty-five miles west of the site in August 1933 when an estimated 24 inches fell in about eight hours.

Average elevation of the site is about 3400 feet above mean sea level. Johnson (1958: Pl. 1) gives the elevation of the base of the Ogallala formation about one-half mile west of the site as 3417 feet. Using this reading as a bench mark, we have estimated the elevation of the arbitrarily-established zero contour line of the map, Fig. 1, at 3365 feet, plus or minus a few feet.

The land immediately south of the site is under cultivation (see map, Fig. 1) but the site itself, situated on very rough terrain, is still in native vegetation. Buffalo grass sod covers the upland areas and the canyon floor and clings — though often somewhat precariously — to even the steepest

of the talus slopes. Prickly pear cactus and soapweed are abundant and in place the talus slopes support mall thickets of short scrubby currant bushes. At present there are no trees nearer than the river valley three and one-half miles distant, and according to older residents there have been none in the canyon in modern times.

The river is also the nearest source of permanent water. After heavy rains runoff water collects in channel-pools in the canyon floor but these are usually short-lived due to rapid evaporation. A tiny seep-spring, located about one-half mile from the site, provides a small amount of water; in wet years it barely replaces evaporation in one or two small channel-pools and fails completely in dry periods. The water from this seep is brownish in color with an "oily" iridescence on the surface, probably due to iron sulfide derived from the shale beds through which it flows (Elias 1931: 60), and is unpalatable even to livestock. (Most likely the canyon received its name from this phenomenon: to some early-day resident the water looked — perhaps tasted — like "coal-oil").

The possibility that a permanent spring, since dried up by a lowering of the water table, might have existed in the site vicinity during prehistoric times is of considerable interest and importance but one that cannot be profitably explored at present for lack of information. The water table today is interrupted five miles to the south of the site by Twin Buttes Creek (Johnson 1958: Pl. 1) and the Ogallala formation (the only upland aquifer) is dissected by two draws between that stream and the site. So it would seem that the only source of spring water in Recent times would be the water table in the Ogallala to the west. Detailed information on the water table in that area is lacking, but a study of the ground-water of Wallace County is now in progress by the State Geological Survey of Kansas and this should provide a basis for estimating the possibilities of a nearby source of water for the prehistoric occupants of Coal-oil Canyon.

METHODS AND DISCOVERIES

Most of the excavation covered by this report was testing in an attempt to discover the extent of the cultural material and the location of any possible cultural features. Little or no evidence of occupation — mounds, depressions, artifacts, camp debris, etc. — was to be found on the surface so testing was necessarily more or less random. Spot checks showed that the cultural material occurred over a fairly wide area and in some rather unlikely places. A reasonably large or prolonged occupation seemed to be indicated and the first problem to locate the living areas. In the absence of surface indications we considered the best approach would be a series of test-pits in the most likely locations.

In western Nebraska the Upper Republican peoples are known to have occupied "rock-shelters" — small caves below overhanging ledges formed in the Ogallala formation by the erosion of unconsolidated material from beneath the harder mortar-bed zones. Reported conditions at these sites (Bell and Cape 1936) appeared somewhat similar to those at Coal-oil and this seemed a good lead to follow. Spot checks made in the large cave at the head of the west gully showed no sign of occupation, but this was not surprising in view of the fact that it is flooded by runoff water from above the ledge after heavy rains. The smaller cave at the head of the east gully could not be adequately tested because of numerous fallen blocks but conditions there are even more unfavorable than at the west cave and it would have made a very poor shelter.

Topography is not favorable for the formation of large overhangs at other places along the ledge in the site vicinity and there are no others at present. The possibility that one might have formerly existed and subsequently slumped in was explored by tests in Areas 1, 2 and 3 (see map, Fig. 1). In all three tests the evidence was decidedly negative. The sketch shown in Fig. 3 can be considered essentially typical of conditions encountered in these three tests. In all instances the only cultural material found occurred in soil that had been deposited after the most recent rock-fall; it had occurred not only above the floor but also well above the roof of any possible overhang.

The cultural material in Area 1 was comparatively sparse and there was no observable stratigraphy within the artifact-bearing zone. Thirty-three arrow-points were found and potsherds recovered here included those from V 6, V 16 and V 26 as well as a large number of pieces of the "Questionable Ceramic Material" (see under Pottery).

In Area 2 cultural material in the form of stone artifacts, potsherds, chips, flakes and scraps of bone (some charred) was found to be abundant in a thin layer of dark, loose rocky soil clinging to the steeply-sloping side of a large fallen block which divides Area 2 from Area 6 (see map, Fig. 1 and Pl. 1, a). This material is precariously held in place by currant bushes and its origin remains a mystery. Stonework and debris were much more plentiful here than pottery: over fifty arrowpoints were found but only a few bodysherds and no rimsherds.

Near the bottom of the west gully immediately below Area 2 a moderately large flat-topped block of mortar-bed, isolated by its height from the rest of the rock-fall, held a few shovelfuls of grassed-over rocky soil in a slight concavity on its top side. In a moment of horseplay during the

lunch hour one day this material was screened, and, to our general astonishment, found to contain a handful of small potsherds, seven arrowpoints and a well-made knife plus a number of chips and bone scraps. Later this find was designated (somewhat facetiously) as "Area" 10. So far it is the only Area of the site to be completely excavated.

The test in Area 3 produced very little debris — bone scraps were scarce, chips rare — and five arrowpoints were the only stone artifacts found. Potsherds were more numerous: all the sherds of RV 3 and over half of RV 2 at a slightly greater depth from the surface. The other fragments of RV 2 were found farther down the slope in Areas 12 and 5.

At this stage of the project the evidence seemed to indicate that the living areas were located on the more level terrain above the ledge and that the material we were finding had been thrown and/or washed onto the talus slopes below. This theory was reinforced by tests on the other talus slopes, particularly in Areas 15 and 16, which produced considerable amounts of burned and unburned bone fragments, tiny bits of charcoal, chips and flakes as well as stone tools and potsherds on terrain which seemed altogether too steep for habitation. Areas 4 and 7, however, did not fit in this theory. Among other discrepancies, they seemed to far from the ledge to have served as middens for living-areas on the high ground and the lines of fallen blocks on the upper part of the slopes would surely have prevented any large amount of surface-washed material from reaching the lower edges.

Area 4 in particular was — and is — a sore puzzle. It was here that the original discovery was made and it proved to be by far the richest Area found so far at the site. Cultural material was remarkably abundant along the edge of the gully. A shovelful of the loose rocky soil might contain several artifacts and dozens of chips and scraps of bone. A total of two hundred and eighty-four arrowpoints, thirty-four knives, eighty scrapers and eight drills were found here as well as sherds of WV 2, WV 4, WV 8, V 1, V 8, V 11, V 15, V 22 and numerous fragments of the "Questionable Ceramic Material." Unfortunately, nearly all the artifacts were located along the edge of the gully where wash, creep and slumping had all but obliterated what stratigraphy might have been present. This Area has the appearance of a midden, but a midden, by definition, implies a living-area of some sort reasonably close by and our tests so far have failed to uncover one.

As work progressed additional discoveries were made which further discredited the washed-over-the-ledge theory. The two hundred and fifty sherds of RV 1 were found strung out around the side of a small boulder on the edge of the east gully in Area 5. They formed a veritable "stream" of

sherds, lying side by side and on top of each other in a narrow band down the steep slope of the gully bank. Near the upper side of the boulder these sherds were mixed with a few from RV 2, V 9 and V 14 and all had obviously been disturbed by erosion. But, just as obviously, the RV 1 sherds could not have been washed far or they would have been considerably more scattered. It seems reasonably certain that RV 1 was broken within a few yards of where the sherds were found.

Area 5 also produced the feature we have called the "Flintpile," which was located about six feet east of the boulder where the RV 1 sherds were found. This feature was an irregular accumulation of flakes and stone artifacts found at eight to twelve inches below the surface. There were one hundred and eight unmodified flakes, ranging from thumbnail size up to two and one-half by three and one-half inches. These showed considerable similarity — the majority undoubtedly originated from no more than four different cores. Thirteen other flakes (most of which probably also came from these same cores) showed enough retouching on one or more edges to be classed as flake knives. Three more, which were thicker and had duller edges, were included in the flake scrapers. The better-made artifacts from the feature were:

2 knives, 1 complete, 1 broken; the complete one is of the type shown in Pl. 13, d, well made and shows little use.

3 broken blades; 2 of these are shown in Pl. 15, b and d (lower piece).

3 complete endscrapers, small and more or less plano-convex; 1 is very well made.

2 chipped objects showing breakage-facets which are probably the bases of missing drill stems.

There were also two specimens shaped by primary chipping to a roughly triangular outline. These, measuring 35 mm. and 42 mm. in length, were classed as arrowpoint blanks.

The artifacts were haphazardly scattered among the unmodified flakes and all the material occurred at essentially the same depth from a rocky irregular surface. It was found in a roughly arc-shaped band about three and one-half feet in length and averaging one foot in width. No sign of an excavated pit could be detected in the vicinity. There were no small chips or other cultural material in association. Cultural material was, in fact, very scarce in the eastern part of Area 5. Excepting the complete knife and endscrapers, which seem rather out of place, this feature appears to have been a cache of valuable chipping material. Our best guess is that the material was

cached in a small shallow pit and that it was later uncovered, strung out and reburied by erosion on the slope. Unfortunately, none of the artifacts are sufficiently diagnostic to associate the feature with a specific complex.

Two features were finally found at the site which could be safely regarded as undisturbed by erosion. Neither did much toward solving where or how the people lived, but one was a very welcome indication of the ground surface during Upper Republican occupation and of the amount of deposition since that time.

A small fireplace was found in Area 2 at sixteen inches below surface, excavated in the tan rocky soil. It was located about three feet from the ledge in the narrow "alley" between the ledge and the large fallen block which borders Area 2 on the north — the same block previously referred to as having the thin layer of soil containing cultural material on its side. The fireplace fill consisted of rocky soil well mixed with black pulverized charcoal which provided a fairly sharp contrast with the surrounding soil. Tiny flecks of pure charcoal were also numerous. It was roughly oval in outline, measuring about twenty-four by thirty inches across and averaging five inches deep. The walls appeared to be nearly vertical. There was no reddening of the soil around the sides or bottom of the pit. One rimsherd and two bodysherds of V 4 and the one rimsherd of V 19 were found in the black fill. Other sherds of V 4 were found in the same stratum in the Area and also strung out below in Area 6. The top of the feature occurred about six inches below the poorly-defined top of the tan rocky soil. This soil graded upward into a somewhat darker, less rocky material. It is probably all disintegrated mortar-bed with the exception of a thin discontinuous layer of fine silt, lying about twelve inches above the top of the feature and about three inches below the surface, which might be wind-deposited soil.

A most interesting characteristic of this fireplace was the occurrence of a cone-shaped mound of "clean" (i.e. containing no charcoal) dirt centered slightly to one side of the center of the pit. At the bottom of the fireplace this mound measured nine inches in diameter and was indistinguishable from the tan rocky soil in which the pit was dug. From the base it tapered to a diameter of about four inches at the top where it was covered by about two inches of the black dirty-charcoal fill. Two possible explanations of this phenomenon have occurred to us, both of which are based on the assumption that the fire was used in firing a pottery vessel: a mound of dirt might have been left in the excavated pit for the pot to rest on, or the unfired pot might have been filled with dirt, inverted in the pit and the fire built around it. When the pot was lifted out after cooling the clean dirt inside would have been

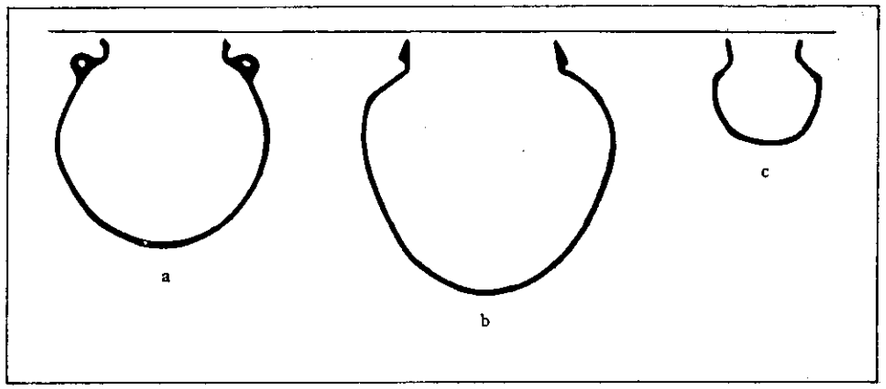
left, surrounded by the remains of the fire on all sides but the bottom. Pots are commonly fired in an inverted position (Shepard 1957: 92) and although I have heard of no instances when they were filled with dirt I am inclined to favor the latter theory.

The presence in the fireplace fill of small rocks and potsherds which showed no signs of burning suggests that the fire was smothered with soil gathered in the immediate vicinity after it had burned out. This would tend to slow the rate of cooling of a pot, which is advantageous in firing most clays (Shepard 1957: 92). Smothering with dirt is also indicated by the fact that the diameter of the black fill averaged about six inches less at the top than at the bottom. This would result from the edges having been raked in toward the center.

The second undisturbed feature was Area 13, located on the east bank of the west gully. Here, at a depth of sixteen to twenty-eight inches from a sloping surface, was found a well-defined occupation level located in a small irregularly shaped area measuring roughly eight by ten feet, nearly surrounded by boulders. The occupation level was marked at the north end by a thin but remarkably heavy concentration of small stone chips, along the east side by two distinct concentrations of bits of charcoal and at the south end by a small but well-defined excavated fireplace.

The fireplace was bowl-shaped, measuring sixteen to eighteen inches across and seven inches deep at center. The bottom third was filled with a loose mixture of black pulverized charcoal, patches of grey-white ash, bits of pure charcoal and small fragments of burned bone. The upper fill consisted of dirty pulverized charcoal, small bits of pure charcoal, unburned bone (including two pieces of rib and a skull fragment of bison) with several fist-size pieces of mortar-bed at the top. There was no sign of reddening around the sides or bottom. Near the south edge of the fireplace was located about a double handful of bits of the Tertiary clay. There can be little doubt that this was carried in by the occupants: it was definitely concentrated and no naturally-deposited clay occurred within several yards. Also, around the southeast half of the fireplace there was a thin irregular band, some four to ten inches wide, of dirty clayey material containing numerous flecks of charcoal. Yellow-buff in color and very unctuous, this material obviously contained a considerable amount of Tertiary clay in pulverized form. It may well have been spilled or left-over pottery clay.

The two concentrations of isolated fragments of charcoal along the east side appeared to be the remains of small short-lived surface fires later disturbed by the elements. The occupation level north of these fire areas was definitely marked by a thin layer of small chips, so numerous as to be over-



Figur Figure 4. Profiles of restored vessels, 14L01. All X 1/5.

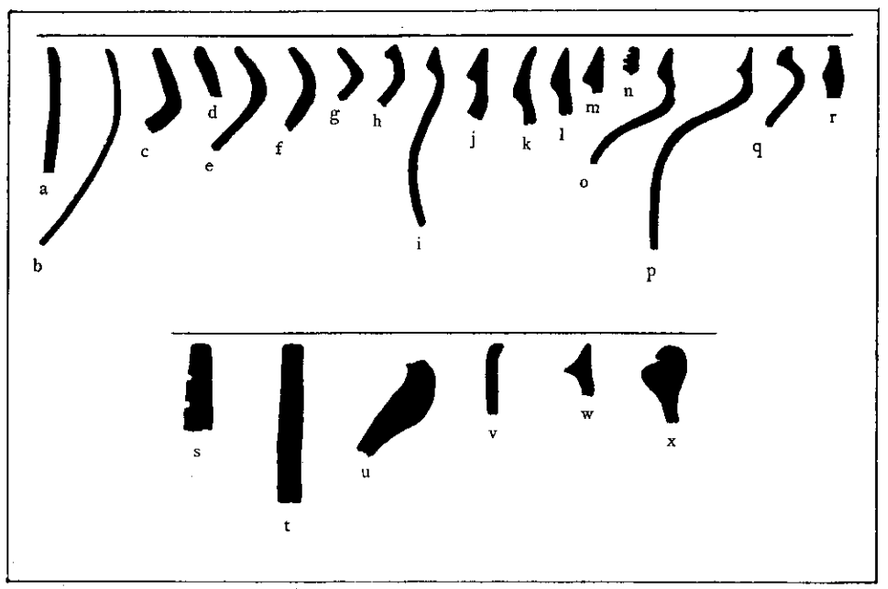


Figure 5. Rim profiles, 14L01. Exteriors to left. a-r X 2/5, s-x X 1.

lapping. The north edge of the Area was sharply delimited by a line of marked soil-change. Evidently a small rill had cut across this end, removing the occupational debris. Later the rivulet was refilled with redeposited material. The occupation area could not have extended much farther north, however, being limited by boulders a few feet beyond the line of soil-change.

A number of artifacts were found at the occupation level in Area 13, including eight potsherds. All were bodysherds but could be confidently assigned on the basis of tempering and surface treatment to the Upper Republican aspect and serve to associate the level with an Upper Republican occupation.

Chipped Stone Artifacts

8 broken or complete arrowpoints, all triangular and small, 6 side-notched, 1 unnotched, 1 indeterminate; 2 of the incompletes have a notch on one side only, suggesting that they were broken in manufacture.

1 complete drill.

2 plano-convex endscrapers, 1 broken, 1 complete.

1 long narrow knife, well shaped but poorly sharpened, with a suggestion of alternate beveling, and both tips (mid-section missing) of a "4-bladed Harahey knife" made of bluish Alibates flint (see under Knives).

1 thin leaf-shaped blade with the end missing.

2 sidescrapers, 1 merely a large retouched flake, the other well shaped out but apparently unfinished.

Sandstone Artifacts

4 rather crude single-groove abraders, 1 showing streaks of red ocher on the back. (One grooved-abrader came from the upper fill of the fireplace.)

1 large mano measuring 5 by 6½ by 2 inches.

Bone Artifacts

2 bone artifacts were found: a punch made from the ulna of a small dog (or coyote) and a pick made from the ulna of a small bison. The pick was found sticking point down near the large mano.

This small Area has more of the earmarks of an open-air workshop than of a dwelling. For one thing, it would have been rather cramped living quarters for more than one person. The fires were located along the edges of the area and there were no signs of a shelter having been used. Also, the features and debris found were more those of the artisan than the housekeeper.

The soil for six to eight inches immediately above the occupation level in Area 13 was dark, fine and contained relatively little mortar-bed detritus. This suggests that it was an eolian deposit and may indicate a period of drouth. (A post-Upper Republican drouth has been postulated for the Plains by Wedel - 1941.) But this layer contained a remarkable amount of bone, which indicates an occupation at this time. Most of the bone was in the form of small scraps but several fragment were complete enough for identification. Among these were 2 scapulae, 3 tibias, 1 humerus, 1 femur, 2 radii and several metapodials and phalanges of bison. It is noteworthy that all recognizable fragments were of limb bones — no ribs, vertebrae, etc., were found. There were a few chips in this layer but not a single artifact. The material above this layer consisted of greyish very compact soil with considerable mortar-bed detritus. It contained a few scattered chips and bone-scraps and is probably a wash. A few thin discontinuous patches of blowdirt occurred on the sloping surface of the Area.

In August, 1957, George Metcalf, of the Division of Archeology, U.S. National Museum, spent eleven days at the site. Much of this time was spent in searching for evidence of permanent habitation on the level terrain above the ledge. No mounds or depressions could be found so testing was in the form of trenches through the most likely Areas. Area 17 was considered very promising in view of the cultural material found in spot-tests in Areas 11 and 15. But, to our disappointment and mystification, Area 17 was found to be completely sterile — not the slightest bit of cultural material was found. Since the possibilities of a rock shelter above Areas 11 and 15 are practically nil and as it is exceedingly difficult to believe that people would have lived on such a steep slope the mystery deepened.

A trench five feet wide and fifty feet long through Area 8 was a bit more encouraging. Three small fireplaces were found at three to four inches below surface with a sprinkling of Upper Republican artifacts in association, but again no trace of a permanent dwelling was found. Spot-tests were made along the north edge of Area 9 (this Area is something of a catchall — mainly a provenience number for the scanty material found, mostly on the surface, south of the fence) but results were inconclusive. A little cultural material was found in a test near the fence south of Area 8 but it was too sparse to be of value.

Chips are present, though not plentiful, in the cultivated field and occasional small potsherds have been found on the surface south of the fence. In the spring of 1957 the farm land was deeply chiseled to prevent wind erosion and a surface survey following this operation found numerous instances where the chisel points had brought up fire-blackened clods. These

were marked and located on the map when the site was topographically surveyed. Several of these locations were excavated. Most showed only faint evidence of small fires and these were marked on the map as "possible fireplaces." At others the evidence of a fire was more definite but in only two instances could an outline of a fireplace be made out and even these were badly disturbed by cultivation. One small piece of the "Questionable Ceramic Material" was found at one of the latter locations but no other artifacts were located during these tests. So there is nothing to tie these fireplaces to any of the ceramic occupations at the site. They may be campfires of the later "horse Indians."

The initial tests were moderately successful in locating the extent of the cultural material but failed in determining the source. Most tests, in fact, raised more questions than they answered. It became apparent that only by thorough, systematic excavation of the various Areas could sufficient information be gathered to solve the puzzle, so testing was abandoned and excavation begun.

THE ARTIFACTS

POTTERY

While the ceramic remains from the site are not especially numerous, they seem to be rather varied and undoubtedly several cultural complexes are represented. We have spent many hours "fitting pottery" and have succeeded in completely restoring three vessels and making partial restorations of several others. Because of the complexity of the material I have decided to describe it by individual vessels as far as possible. The restorations, partial restorations and individual rims are readily adaptable to this method; some bodysherds can be confidently grouped with a rim and a few others are distinctive enough to be safely considered as representative of single vessels. The remainder of the bodysherds have been described as a group.

Restored Vessels

RV 1 (Fig. 4, a; Pl. 2)

This pot was reconstructed from 13 rimsherds (the entire rim) and about 135 bodysherds, the largest of which meaured 2½ inches. There were over 100 other small bodysherds which could not be used in the reconstruction but which undoubtedly belong to the pot. As restored, measurements are as follows: height to lip — 8¼ inches; greatest body diameter (at 4 inches below lip) — 8½ inches; diameter of mouth — 5 inches. Capacity is approx-

imately 4½ quarts. Body shape is globular, the neck merely the point of maximum constriction. The rim is short, rising only ¾ inches above the neck and is variable in profile: For approximately ⅓ of the circumference it resembles a narrow collar with wedge-shape profile, tapering to a thin lip. The remainder is straight and direct to slightly flaring with a broad rounding lip. It gives the impression that the builder's intention was to form a narrow collar all around but that it was not completed. Viewed from above the rim seems to flare slightly. The uncollared section appears somewhat more flaring on the exterior due to a thickening below the lip.

Two handles are located below the rim and appear to have been fastened by welding rather than riveting. The upper ends are attached immediately below the neck line, the lower ends about 1¼ inches lower. They are very nearly diametrically opposed but one is tilted slightly which gives it an appearance of being out of line with the other. Width of both handles is 25 mm. but the tilted one tapers to 17 mm. at the lower end. Thickness of both is greater at the bottom of the loop (15 mm.) than at the top (9 mm.). Center hole of the tilted handle is circular with a diameter of 10 mm.; the other is slightly flattened, measuring 9 by 6 mm. Neither shows sign of wear.

Tempering consists of a moderate amount of sand, ranging in size from medium (Wentworth scale, Table 1) to (rarely) granule, with most particles within the very coarse range. There are also occasional particles of soft non-plastic material composed of silt and fine sand, white to light grey in color, with the same size range as the sand. These are highly calcareous and from all appearances are bits of the local mortar-bed, no doubt gathered with the sand.

Exterior color is variable, ranging from nearly black through dark grey to medium grey. There are also two large buff-colored clouds (on opposite sides of the pot) and smaller areas of buff to dark brown. The interior surface is mostly covered with a thin coating of material as yet unidentified. This material is soft, and tan for the most part but in some areas is carbonized black. Small patches of the interior not covered are light grey to blue-grey in color. Core of most sherds is dark grey. Sherds from this vessel re-fired under oxidizing conditions turn light red-orange indicating that it was made of ferruginous clay containing considerable carbonaceous matter and that it was partially and unevenly oxidized during firing.

Body thickness varies from 4 mm. to 9 mm. Both extremes occur close together on both upper and lower body so the variation would seem to be a result of accident rather than design. Extremes are not common however, most sherds running close to 6 mm. in thickness. Hardness averages about 5. Sherds have moderately high breaking strength and fracture lines are irregular. Paste texture, exclusive of temper, is more grainy than smooth. The interior surface, where it is not covered by the tan material, appears to have been rather carelessly evened and smoothed, particularly in the area just below the neck. That the exterior was not evened by scraping is indicated by numerous small mounds, depressions and flat spots.

There is a rather distinct difference in surface finish between the upper part of the body and the lower. Over the upper section (extending roughly to one inch below the handles) paddle marks are much in evidence smoothing is less carefully done — particularly on the rim — temper rarely shows on the surface and there is no attempt at decoration. On the lower part paddle marks are very rare and temper particles show more frequently on the surface, though they do not protrude. Also, the only marks which could be considered as decoration occur on the lower part, confined mostly to a band 4 inches wide around the greatest diameter of the body. These consist of series of three to five short impressed lines, more or less parallel, ¼ to ½ inch long and consistently spaced about ⅛ inch apart. Almost invariably these lines run transversely across a short shallow trough whose width corresponds to the length of the lines. In general, the longer lines occur in the deeper troughs, the shorter ones in the shallower. Apparently they were made with a cord-wrapped rod. The series are haphazardly located and oriented and the operation seems to have been generally careless. On the lower third of the body there are also a few lightly incised lines of various lengths that are entirely haphazard and probably accidental scratches.

This pot is a bit of a puzzle. Paste and tempering are well within the Upper Republican ceramic tradition and the attempt at collaring is also suggestive of Upper Republican. But handles are not common in that aspect and when they occur invariably extend from shoulder to lip. Globular bodies are not generally characteristic of Upper Republican, though they occur in some foci. The handles resemble those of the Great Bend aspect in being attached below the lip, but Great Bend handles are usually fastened by riveting rather than welding and body shape of Great Bend vessels is subconical with either flat or round-pointed bases (Wedel 1942: 5, Pls. 2, 3). Wedel also states (1942: 5) "With some exceptions, the pottery is of mediocre quality and looks like the result of a decadent industry." This could not be said of RV 1. Body shape suggests Middle Mississippi influence but few if any other Middle Mississippi traits are present in the vessel.

Unfortunately, provenience provides no clues to cultural affiliation. The sherds were found a few inches deep strung out down a steep slope

along side of a block of mortar-bed and no diagnostic cultural features have yet been found in the vicinity. At the upper end of the block a few sherds of this vessel were found mixed with Upper Republican sherds, both rim and body, but since all the material had obviously been disturbed by wash this association has little value. More information than is available at present will be needed to even tentatively assign this pot to a cultural complex. It may be a product of transculturation. It could belong to a complex as yet unrecognized in the High Plains area. Or it may be the work of the "village oddball."

RV 2 (Fig. 4, b; Pl. 3)

Ten rimsherds and about one hundred and forty bodysherds of this vessel were found scattered throughout Areas 3, 5 and 12. We were able to fit nine of the rimsherds and sixty-one of the bodysherds into a reconstruction of half the rim and one side of the body down to and partly around the bottom, from which the restoration was completed with plaster. As restored, dimensions are as follows: height to lip — 10 inches; maximum diameter (at 3½ inches below lip) — 10 inches; diameter of mouth — 6 inches. Capacity is about 7 quarts.

Body shape is conoidal with gently rounding base. Shoulder area is rounded and slopes upward to the neck at a 45 degree angle on the average. Body contour is slightly asymmeterical, which may be partly, but not entirely, due to the difficulties of restoration. The rim is of the typical Upper Republican "collared" or "braced" variety: From a rounding lip the outer surface slopes outward and downward to a point about ⅞ inch below the lip. From there it undercuts inward and downward for about ⅜ inch, then recurves outward and downward to the shoulder point, leaving a broad "groove" just above the neck. Since the inner surface is straight, or very slightly curving, the lower edge of the collar is considerably thicker than the lip and above the groove the rim is roughly wedge-shape in profile. The lip is uneven and the height of the rim varies from 1¼ inches to 1½ inches above the neck. Rim and lip are undecorated and carelessly smoothed, presenting a rather uneven surface.

Exterior body surface is fairly even but there are minor bulges and flat spots, indicating that it was not evened by scraping. The interior surface was well smoothed but very uneven. The interior of the rim and for a short distance below the neck shows striations suggestive of grass-wiping.

The entire exterior below the neck was covered with cord impressions. On an inch-wide area immediately below the neck the lines are parallel and

vertical. Below this area and extending to approximately the line of greatest body diameter the lines are more or less parallel and horizontal. Below this the lines are haphazardly oriented in groups at various degrees from the vertical and often criss-cross.

Color of the interior is light to dark grey. The exterior color shades from medium-dark grey at the base through grey-brown to brown at the shoulder area with tan and reddish-tan spots on the rim. Color of the core is rather uniformly medium grey except in the vicinity of the tan spots on the surface, where the core is also tan to various depths. Coloring indicates that the pot was made from carbonaceous clay and was unevenly and partially oxidized in firing. Sherds from the pot re-fired in open air turn medium orange-tan indicating presence of iron oxide, Experiments I have made suggest that the carbon in the clay is held rather tenaciously, requiring a considerable length of time to burn it out. Hardness is about 5 and the re-fired sherds are only slightly harder.

Temper is rather sparse and consists of very coarse sand, fairly uniform in size. There are numerous bits of mortar-bed the size of the sand temper, indicating that the temper was gathered locally. Texture of the fired clay is grainy rather than smooth and slightly porous. Sherd thickness varies from 3 to 6 mm. but most run close to 5 mm. There is no apparent relationship between sherd thickness and body area. Sherds are not easily broken and fracture lines are moderately irregular. There is a tendency toward splitting in some sherds. I can find no positive evidence of the method of building.

In rim shape, body shape and size, tempering and surface treatment this pot approaches identity with certain ceramic remains of the Upper Republican aspect in south-central Nebraska as described by Strong, Wedel and others.

RV 3 (Fig. 4, c; Pl. 4)

This little vessel was irregularly shaped and badly shattered, which made restoration and accurate measurement rather difficult. It was reconstructed from three small rimsherds and about forty bodysherds, all found in Area 3. Fifteen other bodysherds were too fragmentary to be used in the restoration but were undoubtedly part of the original pot.

Body shape is very irregular and the greatest diameter (roughly at the shoulder point) varies from 3½ to 4 inches. Height is approximately 4 inches and mouth diameter averages about 3 inches. Capacity is ¾ pint.

The three small sherds are scanty evidence for reconstructing the rim but it appears to have been straight and direct to slightly flaring, rising about ⅜ inch above a poorly-defined neck line. The lip is rounded and probably undecorated. Shape of the lower body is roughly spherical. The shoulder is moderately to sharply angular, with the shoulder point located 1 to 1¼ inches below the lip.

It is tempered with a very small amount of medium to coarse sand, with an occasional particle of mortar-bed of the same size, indicating that the temper was obtained in the local area. Also occuring in the paste, in some sherds more frequently than the sand temper, are bits of unmixed clay ranging in size up to 4 mm. These particles are identical in appearance with the Tertiary clay that underlies the mortar-beds in the site locality. Since particles of clay, being plastic, would be of no value as temper it seems probable that the vessel was made of the local clay and that it was not pulverized or well mixed prior to shaping. Color, which ranges from orange-buff at the base to bright red-orange at the shoulder and rim and over most of the interior, agrees with that of the local clay when fired under oxidizing conditions. Hardness, about 5, and texture — smooth, compact and flaky — are also similar to the local clay when fired at a moderate temperature.

Thickness varies from 9 mm. in places at the shoulder to 4 mm. at the rim but averages 5 to 7 mm. Sherds are hard and unusually strong, fracture lines irregular with sharp angular edges. There is no decoration. Body contour is not symmetrical and gives the impression of having been carelessly shaped. Exterior surface has been well smoothed and compacted but is extremely uneven. Interior is less well smoothed but is somewhat evener. Narrow ribbon-like tool marks, running mostly at sharp angles to the vertical, are visible on the interior below the shoulder. Most probably the vessel was lump modeled.

Name	Grade Limits (Diam. in mm.)
Pebble	64-4
Granule	4-2
Very Coarse	2-1
Coarse	1-1/2
Medium	1/2-1/4
Fine	1/4-1/8
Very Fine	1/8-1/16
Silt	1/16-1/256

Table 1 Wentworth's Size Classification

In many places the exterior surface has "popped," undoubtedly during firing and possibly because of inadequate drying, leaving round pockmarks from 5 to 25 mm. in diameter and occasionally half the body thickness in depth. Two areas near the shoulder are very badly shattered in addition to the pop marks and it seems probable that the vessel broke during firing and was never used. No soot was found on any of the sherds.

The general carelessness manifested in mixing the paste and in shaping, finishing and drying this vessel are characteristic of the decadent ware of the historic Pawnee (ca. 1800 A. D.). Although the Pawnee are known to have hunted widely over the High Plains, their pottery has rarely, if ever, been found any distance from their large permanent villages in southeastern Nebraska. No material other than pottery that could be definitely assigned to the historic Pawnee has been found at Coal-oil, so assignment of this vessel should perhaps remain tentative for the present.

Woodland Sherds

Two rimsherds and thirty-three bodysherds from the site seem to fit in the Woodland pattern. At least eight vessels are represented and tempering material (and possibly building method) seems to indicate two separate foci.

WV 1

Six bodysherds from Area 7 are undoubtedly from the same pot. They are heavily tempered with pounded calcite, particle size ranging from very fine to granule. Particles are mostly angular, often sharp. There are also occasional fine bits of red ocher in the paste which may be natural inclusions. Color of the interior surface is dark grey to nearly black; that of the exterior is light grey. Color of the core on old breaks is the same as the exterior surface, but on fresh breaks it is dark grey to dark purple-brown. Hardness is around 4, thickness averages about 7 mm. Apparent texture is very coarse due to temper. Texture of the paste exclusive of temper seems to be rather smooth and flaky. Sherds are fairly easily broken and fracture is highly irregular. Interior surface is smoothed but uneven; exterior seems to be fairly even on the small areas presented by the sherds and is cord-marked. The cord marks are very shallow, average about 2 mm. in width and are parallel. They show no evidence of over-smoothing. Temper shows regularly on all surfaces.

The largest sherd shows excellent evidence that the vessel was built by the coiling method, using a pronounced exterior overlap, and two other sherds also show strong evidence of coiling. This feature and its implications

has been discussed by Metcalf (no date). In all three sherds the cord impressions run at 90 degree angles to the coil-lines.

WV 2

Eight bodysherds from Area 4 are sufficiently alike to be grouped as remnants of a single vessel. They are tempered with a moderate amount of pounded calcite. Particles are mostly sharp and angular, ranging from fine to pebbles more than 5 mm. in length. Small bits of red ocher are fairly numerous in the paste. There are also numerous particles of a very soft, cream to pinkish, highly calcareous substance that resembles Niobrara chalk. These bits range from fine to granule in size. Calcite occurs locally as crack-filling seams in the Smoky Hill chalk member of the Niobrara formation in Logan County and bits of chalk may have been gathered with the calcite. Color of the core and interior surface is light purple-brown. Exterior color is mostly very dark grey (nearly black) but shades to dark purple-brown. Thickness is about 8 mm. Hardness averages little more than 3.5 but the sherds have an appreciably higher breaking strength than those of WV 1, no doubt because of less temper. Apparent texture is rather variable: Where temper particles are large and numerous texture appears very coarse and fracture lines are irregular, but texture of the clay itself is smooth and flaky and some broken edges appear relatively smooth. I would guess that this vessel was made from clay very similar to that used in WV 1 but that the latter was fired to a somewhat hotter temperature.

Interior surface was smoothed but is uneven. The exterior is roughened by neatly-spaced cord impressions about 2 mm. wide and rather deep. Temper shows regularly on the interior but less frequently on the exterior. Three of the sherds show incised or trailed lines, applied after the cord marks, but are far too small to give any idea of the pattern. On two of the sherds the lines are shallow and run at approximately 45 degree angles to the cord marks; on the third the line is much deeper and cuts across the marks at a 90 degree angle. This may indicate a triangular motif.

The two largest sherds show evidence of coiling, which has also been described by Metcalf (no date). As with WV 1, fractures along the poorly-welded coil-lines run directly across the cord marks, indicating that the latter ran vertically.

WV 3

One bodysherd from Area 11 is heavily tempered with pounded calcite, particle size ranging from medium to pebbles of 4 mm. Exterior color and

that of the core is dark grey to black. Interior color is brownish-grey. Hardness is between 4 and 5, thickness 8 to 9 mm. Breaking strength is low, fracture highly irregular. Exterior surface has been very lightly roughened, probably with a cord-wrapped paddle, but the impressions are too indistinct for the pattern to be determined. The interior surface is poorly smoothed and extremely uneven. Three other small bodysherds from Area 4 are similar in most respects and may or may not belong to this pot.

WV 4

Three small bodysherds, one from Area 4, the other two of doubtful provenience, are heavily tempered with pounded calcite. Particle size varies from fine up to 3 mm. The sherds are buff to dark grey in color, about 3.5 in hardness and 8 to 11 mm. thick. Both interior and exterior surfaces have been roughened, apparently with a paddle wrapped with a two-strand twisted fibrous cord, but the sherds do not present a large enough area for the regularity of the pattern to be determined.

WV 5

One small bodysherd from Area 7, moderately tempered with pounded calcite. Thickness is 9 mm., hardness about 5. Exterior surface is medium to dark grey and very lightly and irregularly marked — almost plain. Core is dark grey. This sherd is badly split and only a small portion of the interior surface remains. It seems to have been very well smoothed and is a clear buff in color.

WV 6

One small bodysherd from Area 9, heavily tempered with very coarse sand, about 5 in hardness and 7 mm. in thickness. Color is light cream to dirty white throughout. Interior surface is well smoothed but uneven. Exterior is cord-roughened with impressions apparently parallel, shallow and about 2 mm. wide.

WV 7

Five bodysherds from Area 7 are tempered with a moderately heavy amount of sand, particle size ranging from fine to rare pebbles of 4 mm. Color is light to dark grey on the interior and buff shading to light grey on the exterior. Core is buff on the exterior half, light to dark grey on the interior half, indicating incomplete oxidation of carbonaceous matter in the clay. Hardness is nearly 5. Thickness varies from 8 to 11 mm., averaging about 10 mm. Apparent texture is very coarse, due to temper. Interior sur-

face is well smoothed but slightly uneven. The exterior has been cord-roughened, leaving shallow parallel impressions about 3 mm. wide.

Another small bodysherd from Area 7 is similarly tempered and marked but is thinner (6 mm.) and buff to reddish-buff throughout. It may be from another vessel.

WV 8 (Fig. 5, a; Pl. 9, a)

This vessel is represented by two rimsherds and four bodysherds found in Area 4. One rimsherd and one bodysherd fit, providing a short profile of the rim and neck. The rim is direct, the neck indeterminate — merely a continuation of the apparently gradual curve of the upper body. The lip is flat, squared and undecorated. Diameter of the mouth can be only roughly estimated but was probably at least six inches but not more than seven inches.

The sherds are heavily tempered with very fine to (rarely) coarse sand. Color of the exterior is buff to tan; that of the interior is tan at the rim but shades to grey about two inches below the lip. The core is also light grey but this color feathers out upward at the center, leaving the core a uniform tan at the lip. This, and the grey interior, indicates uneven and partial oxidation of a carbonaceous clay. Thickness is uniform, 6 to 7 mm. except at the lip where there is a gradual taper to 4 mm. Hardness is difficult to test by scratching because of the abundant temper but is not much over 3. Apparent texture is very grainy. Texture of the clay cannot be determined visually because of the amount of temper. Sherds are not easily broken and fracture lines are moderately irregular.

Both interior and exterior surfaces are even and the interior is very well smoothed. The exterior was lightly cord-roughened, leaving parallel-vertical impressions that are not easily distinguished by the unaided eye. Under a 10 power lens minor ovoid depressions are visible within and usually at a slight angle to the lines of impression, as if a two-strand twisted cord had been used. There are also minute irregular impressions within the depressions, indicating that the cord was fibrous. The parallel-vertical impressions continue up to the lip; there is no decoration in evidence. No tool marks or other indication of building method are present.

Partial Restorations and Individual Rims

V 1 (Fig. 5, c; Pl. 8, b)

The seven rimsherds and seventy-five bodysherds of this pot were found in Area 4. Four rimsherds that fit together make up a little less than

¼ of the original circumference of the mouth. We have made some partial restorations of a few of the bodysherds but unfortunately none of the bodysherds fit the rims so no estimate can be made of body shape or size. However, all sherds are identical in tempering, surface treatment, etc., and there can be no doubt that all are from the same vessel.

On the partial rim restoration the rim and body juncture makes very nearly a 90 degree angle. The rim is approximately 1¼ inches high, straight and moderately flaring. Mouth diameter, estimated at 6½ inches, is about 1½ inches greater than that of the neck. Lip is the same thickness as the rim, rounded and undecorated. The cord impressions on the body exterior were continued up the rim but in places appear to have been obliterated by over-smoothing.

The sherds are fairly heavily tempered with sand, particle size ranging from fine to granule though both extremes are rare. The temper seems to be rather unevenly distributed. There are occasional particles of mortar-bed and it is probable that the temper was locally obtained. Color of the interior, exterior and core is mostly dark grey-brown to black. A few bodysherds are medium grey with buff tones, indicating partial oxidation during firing. A sherd re-fired in open air turned reddish-tan so the clay used was probably ferruginous with considerable carbonaceous material. The black areas may be at least partially due to sooting or smudging during use. A great deal of carbon was present on most sherds, both inside and out, not in soft laminated layers but a rather tough "hide," in places seemingly burned into the pores of the clay. There is a thin layer of soft tan material on the interior of a few sherds.

Surface hardness is about 5. Thickness varies from 8 mm. (at the neck) to 3 mm., but most sherds are near 5 mm. Core texture appears coarse on most sherds because of the abundant sand temper. Both interior and exterior surfaces are evened and the interior is fairly well smoothed. The exterior has been cord-roughened and presents what may be described as a field of roughly oval impressions, closely spaced, 1 to 2 mm. in width. On many sherds they are rather shallow and indistinct, but where the impressions are deeper they appear in a fairly regular pattern, often vaguely linear, occasionally suggestive of crossing diagonals as in a honeycomb (Pl. 10, a-d). They are somewhat similar to sherds from Toole County, Montana described by Wedel (1951: 131, Fig. 1, A-F) as fabric impressed. However the sherds from this vessel differ from the illustrated Montana sherds in that the depressions present a somewhat more regular, linear pattern. I have obtained a very similar effect on plastic clay (Pl. 10, e) by impressing it with a paddlet wrapped with a 2-strand twisted cord of my own manufacture. The knurled surface of the twisted strands (each 1 mm. in diameter) pro-

duced ovaloid impressions identical with those on this vessel and I found that regularity and distinctness of pattern would vary with wetness of clay, type of clay and care used in paddling. I believe that a tool of this type very probably was used in roughening this vessel.

This roughening techinque seems to be similar to that used on Woodland Vessel 8, the main difference being that the latter was more lightly impressed (or the clay was less plastic), with parallel lines more in evidence. The abundance of sand temper in V 1 also hints at Woodland but the rim seems more in the Upper Republican tradition. In rim shape, thickness at the neck and other features this pot appears similar to the Horsehead Creek material from the Angostura reservoir area in Fall River County, South Dakota, as described by Hughes (1949: 274-5, Fig. 68, i). Though no braced rims were found Hughes feels that the Horsehead Creek pottery is assignable to the Upper Republican aspect and states (ibid: 275): "On theoretical, typological grounds, one is tempted to speculate that components lacking the braced rim will be found, that these components may prove to be earlier than those with both rim forms, and that the site on Horsehead Creek may turn out to be such a component."

V 2 (Fig. 5, d; Pl. 8, c)

One rimsherd from Area 16. The sherd is straight and broken at the neck but indicates that the rim was moderately flaring. It is undecorated, poorly evened and smoothed, all in all a rather crude specimen. It is moderately tempered with fine to medium sand. There are also numerous fine flaky particles of a white non-calcareous material in the paste. This material dissolves without effervescing in warm dilute hydrochloric acid and appears to be gypsum. Some beds of the local Pierre shale contain small particles of crystalline gypsum that are transparent and mica-like in the natural state but turn white and opaque when fired to the moderate temperature where gypsum is dehydrated. Firing experiments I have made with this material closely resemble this sherd in silty, grainy texture, dark grey color, and in the occurrence of the fine white particles.

V 3 (Fig. 5, e; Pl. 7, a)

This vessel is represented by five rimsherds and forty small bodysherds from Area 7. A partial restoration has been assembled from all the rimsherds and eight of the bodysherds, which makes up about ⅛ of the original circumference of the mouth. It extends little below the neck however, and no estimate can be made of body dimensions.

The rim rises about 1¼ inch above the neck, is straight to very slightly curving and moderately flaring. Mouth diameter was about 6½ inches, that of the neck about 1¼ inch less. The angle at rim-body juncture is about 100 degrees and the upper body appears to have been rather steeply-sloping. The rim is fairly well shaped but poorly evened and smoothed, especially on the outside. Lip is rounded and has been decorated with parallel-diagonal impressions. These are spaced 10 to 12 mm. apart, rather broad and deep, and for the most part are crudely applied.

As nearly as I can determine using a 10 power lens this pot was, for all practical purposes, untempered. A few grains of coarse sand, or pits where such grains might have been, are present but are extremely rare and their value as temper would have been negligible. The possibility that silt-size material was added for temper cannot be discounted by visual inspection but I think this unlikely. Paste texture is identical with that of some firing experiments I have made with local Pierre shale and I have found that with ordinary care in mixing, drying, pre-heating, etc., serviceable pottery can be made from the shale without tempering. Occasional small angular bits of the clay in most sherds indicate that it was not well pulverized — probably it was prepared by soaking rather than grinding.

Color of the core and interior surface is dark brown through medium grey to light grey and grey-buff, indicating presence of ferrous oxide and carbonaceous matter in the clay. These characteristics conform closely to those of some beds of Pierre shale in the site vicinity. Body and rimsherds run close to 5 mm. in thickness, those in the neck area around 9 mm. Surface hardness is 4.5 to 5, paste texture silty. Breaking strength is rather high and fracture lines irregular. Interior surface seems to have been fairly well evened and smoothed, except in the rim and neck areas, but is not tactually smooth, i.e. does not have a "slick" feel. The exterior is moderately even and was roughened by cord impressions about 1.5 mm. in width. These run diagonally, sloping upward to the left, on the shoulder area with some criss-crossing apparent on the small bodysherds. There was no smoothing over the cord marks.

Surface treatment on this vessel is characteristically Upper Republican. Flared rims are present in most, or all, foci of that aspect and therefore are not reliable focal determinants. Lack of temper may be due more to individual adaptation to local material than to ceramic fashion but probably this vessel belongs somewhere in the later Upper Republican tradition.

V 4 (Fig. 5, f; Pl. 7, b)

Six rimsherds and one hundred and eighty-nine bodysherds have been grouped, though in some cases a bit hesitantly, as representing one ves-

sel. They were found rather widely scattered through Areas 2 and 6 and few of the bodysherds fit the rims. There is also considerable variation in color, though none that cannot be accounted for by uneven oxidation or reduction during firing. All sherds, however, display an identity in temper, paste texture and surface finish, particularly on the interior, that warrants an assumption that they belong to the same vessel. All six rimsherds fit together and with one bodysherd, providing a basis for estimating rim dimensions, but no estimate can be made of body shape or size.

The rim is short, ¾ to 1 inch high, straight and moderately flaring. Mouth diameter is estimated at 6 inches, neck diameter about 1½ inches less. The angle at rim-body juncture is about 120 degrees which, considering the degree of rim flare, indicates that the upper body was rather steeply-sloping. The lip is somewhat squared and flattened for the most part but is markedly thinned at one point; it is uneven and seems to have been carelessly modeled. There are faint traces of parallel-diagonal impressions on the squared sections of the lip but they are all but obliterated by over-smoothing.

Tempering is rather sparse and consists of very coarse sand, fairly uniform in size. There are also numerous bits of mortar-bed in all sherds The temper is very reminiscent of the material to be found on ant-hills in the site vicinity. Vessel walls were very thin except in the neck area. Nearly all bodysherds measure 3 to 4 mm. and a few are 2 mm. thick, while those in the neck area measure up to 8 mm., averaging about 7 mm. One of the largest sherds, undoubtedly from the upper body, tapers from 6 mm. to 2 mm. in a distance of 2 inches. Surface hardness is about 5.5, paste texture very compact and flaky. Fracture lines are highly irregular with sharp jagged projections on most edges. Fine cracks and checks, some of which extend through nearly half the thickness of the sherds, show on most sherds, particularly on the interior surface. This is probably a result of too rapid drying. The paste seems to have been rather poorly mixed and worked which, together with thinness and the drying-cracks, makes for low breaking strength and no doubt accounts for the fact that most sherds are very small.

Interior color varies from light silver-grey to black, that of the core from light grey to black and occasionally light reddish-buff. Exterior color ranges from light to very dark grey and from light buff to dark brown. A sherd re-fired in an oxidizing atmosphere came out light red-orange. I would guess that this pot was made from a ferruginous clay containing little or no carbonaceous matter and that it was fired in a fluctuating atmosphere, mostly reducing, occasionally oxidizing, and with some sooting and smudging in spots. There was considerable soot on both inside and outside of many

sherds and traces of a soft tan (vegetal?) material on the inside of some. Both interior and exterior surfaces were poorly evened but well smoothed and compacted. A few bodysherds show faint, nearly obliterated cord impressions but most sherds, both rim and body, are plain. It seems probable that this vessel was lump-modeled and the walls thinned and evened by stretching and/or paddle-and-anvil. There is positive evidence that it was not thinned by scraping.

This vessel seems rather hastily and carelessly made and the lack of specialized features such as decoration or roughened surface makes it difficult to determine its cultural affiliation. It could fit somewhere near the borders of the Upper Republican aspect. In sparseness of temper, thinness of body walls and the short flaring rim, however, it is similar to the pottery of the Dry Creek focus from Fall River County, South Dakota (Hughes 1949: 276-7. Fig. 68, a). But the Dry Creek sherds are tempered with "large angular particles of crushed quartz" and/or "tiny thin flecks of pulverized bone," are usually decorated and often show grooved-paddle marks. Pottery which Hughes considers closely similar to Dry Creek has been found over a wide area in western Nebraska and bordering areas and is sand tempered in at least two instances (Wedel 1947: 157-9). Much of this material has not been studied in detail and no attempt has been made to group it into taxonomic units but both Hughes and Wedel believe it to be late prehistoric or early protohistoric in age with eastern ("Siouan" or "Middle Mississippian") affiliations.

A few sherds of V 4 were found associated in a fireplace fill with the V 19 rimsherd. This rimsherd is straight-direct, sparsely tempered, shows parallel-horizontal incised lines on the rim and parallel-diagonal lines on the lip — all characteristics of the Dry Creek-like pottery. Both V 4 and V 19, however, show some indications of cord-marking and no sign of the grooved-paddle marks characteristic of the Dry Creek sherds. It is tempting to speculate that V 4, V 19 and probably V 20 are peripheral "Dry Creek" with late Upper Republican influence — or late Upper Republican with "Dry Creek" influence.

V 5 (Fig. 5, g; Pl. 8, a)

Two rimsherds, one small bodysherd from Area 5. Rim is short (¾ inch) and moderately flaring. Mouth diameter was about 6 inches, neck diameter about 1 inch less. Lip is rounded and decorated with indistinct parallel-diagonal impressions sloping inward to the left. Rim is undecorated and poorly smoothed on the exterior. It is tempered with a moderate amount of medium to coarse sand. Exterior color is dark brown to brown, interior dark grey

to grey-buff. Color of the core is uniformly medium grey. Hardness is not quite 5, thickness 4 to 6 mm. Interior surface uneven but moderately well smoothed. Exterior was cord-roughened with impressions averaging 1.5 mm. in width, running parallel-vertical in the neck area.

This vessel is Upper Republican, probably close to the "classic" (Lost Creek-Rebecca Creek) focus.

V 6 (Fig. 5, h; Pl. 8, g)

Three rimsherds and forty-five bodysherds of this pot were found in Area 1. All the rimsherds and six bodysherds fit together in a partial restoration that provides a basis for estimating rim shape and size but not body dimensions. The rim is about ⅞ inch high, straight to very slightly curved and slightly flaring. Diameter of the mouth was about 5 inches, that of the neck about ½ inch less. The lip is broad and markedly flattened at a 45 degree angle. The pressure exerted in shaping the lip has produced a thickening, or bead, on the outside which gives the impression of a more pronounced flare on the exterior than the interior. Viewed in profile it suggests incipient collaring and invites speculation on transitions between straight flared rims and collared ones. The lip has been decorated with a series of punctate-impressions spaced about 10 mm. apart. The punctations are roughly conical, about 2 mm. deep. Leading outward and to the left from them are impressions that slope upward from the bottom of the punctation to the surface at the outer edge of the lip. They seem to have been made with a sharp pointed angular tool. I have made very similar marks on plastic clay by using a bone splinter awl from the site. The procedure apparently was something like this: The punctations were made with the tool held perpendicular to the plane of the lip. It was then withdrawn and the sloping impressions made by holding the tool at a slight angle to the lip and pressing the point to the depth of the punctation. Each impression made a minor bulge on the interior of the rim.

Tempering is moderately sparse and consists of coarse to very coarse sand evenly distributed. Color of the interior surface is a uniform red-orange. Exterior color shades from reddish-buff to light red-orange and a few sherds are greyish, indicating "firing clouds." Core is red-orange for the most part but a few sherds show a thin grey line at the center, suggesting that the clay contained some carbonaceous matter which was not completely oxidized. Body thickness varies from 4 mm. to (rarely) 7 mm., averaging about 5 mm. Hardness is not quite 5. Breaking strength is moderately high and fracture lines irregular. Texture of the paste, exclusive of temper, is more silty than smooth. The interior surface is well evened but does not have a smooth

feel. The exterior surface appears to have been lightly roughened by a paddle wrapped with a rather heavy single-strand cord. The impressions are relatively broad (2 to 3 mm.), widely spaced but roughly parallel, and shallow. They have been nearly obliterated on many sherds by over-smoothing. The impressions continue up the rim to the lip with less over-smoothing on the rim.

Rims of this kind occur in the St. Helena (Cooper and Bell, 1936) and Sweetwater (Champe and Bell, 1936) foci of the Upper Republican aspect.

V 7 (Fig. 5, i; Pl. 7, c)

Two rimsherds and seven bodysherds of this vessel were found close together in a small test in Area 15. The two rimsherds and two relatively large (for Coal-oil) bodysherds fit together in a partial restoration from which estimates can be made of rim and upper body dimensions. The rim is braced, about 1 inch in height, with a collar averaging ½ inch wide. The interior line (i.e. the interior surface from lip to neck) is straight and flares slightly. The lip is fairly thin, more flat than rounded, and undecorated. There seems to have been a few cord impressions haphazardly applied on the collar and groove but these were mostly erased, leaving the rim essentially plain.

Mouth diameter was close to 6 inches. The shoulder slopes very sharply from the neck and the greatest body diameter (at around 2½ inches below the lip) was little more than 7 inches. A relatively small, wide-mouthed vessel is indicated. It is very sparsely tempered with coarse to very coarse sand. Hardness is little more than 3 and paste texture is definitely silty. Wall thickness is fairly uniform at 4 to 6 mm. Considering thickness, breaking strength is rather low. My impression is that the vessel was not fired as long, or as hot, as it might have been. Color of both surfaces is very dark grey with a dark brownish tone in places and occasional indications of small buff "clouds." Core is uniformly very dark grey — almost black.

Exterior surface of the body was cord-roughened. The impressions are moderately deep, wide (2 to 4 mm.) and closely spaced, running essentially parallel-vertical on the upper body. The entire vessel was apparently smoothed while in the leather-hard state with a hard, smooth tool. The interior is somewhat uneven but is tactually smooth and has a slight luster on the "high" spots. The rim and the ridge between the cord marks on the exterior also have a slick feel and a definite luster.

This vessel undoubtedly belongs somewhere in the Upper Republican aspect.

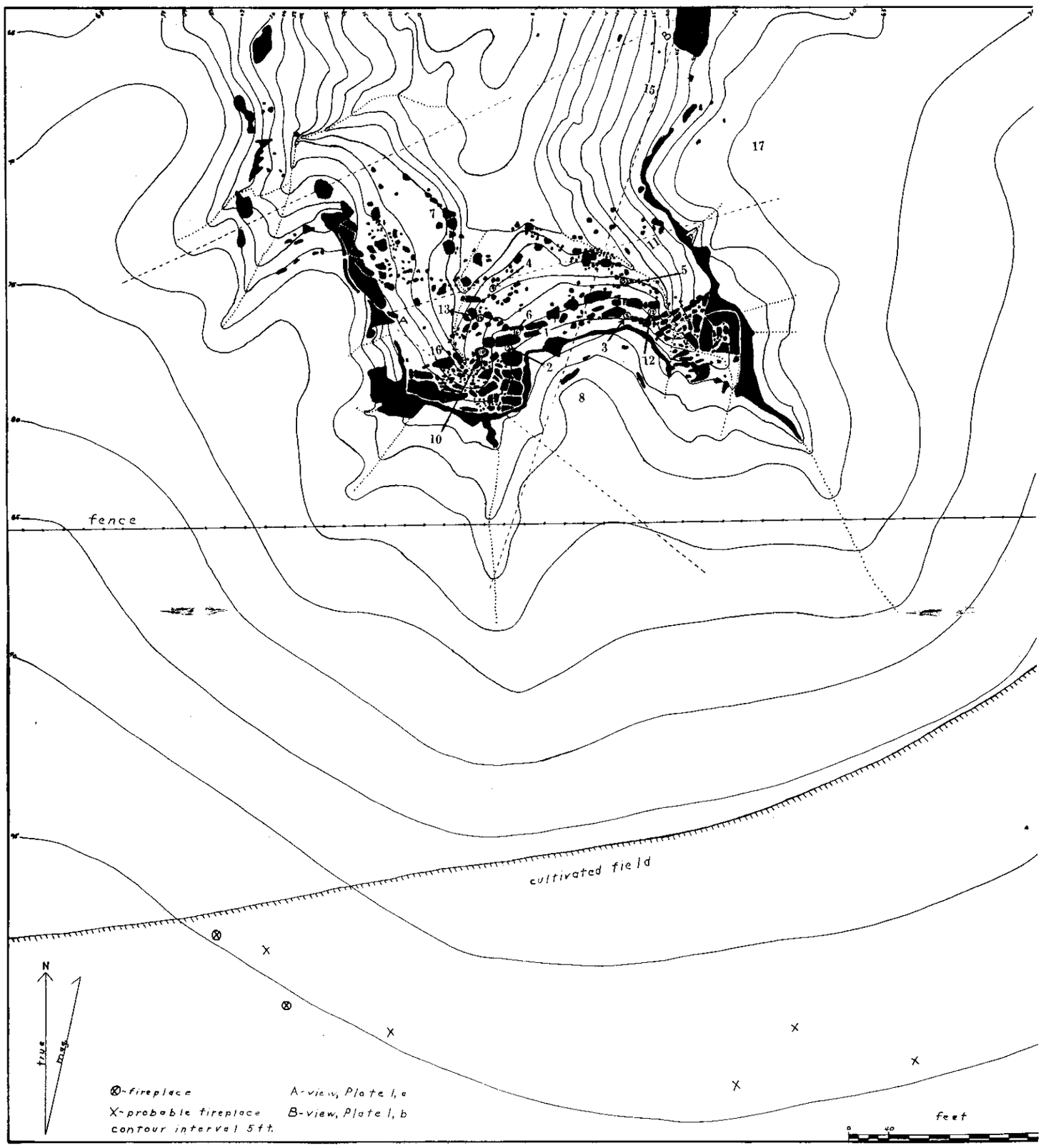


Figure 1. Contour map, site 14LO1. Circled numbers indicate tested areas. Black indi
mortar-bed ledge and fallen blocks.

V 8 (Fig. 5, j; Pl. 8, f)

Ten rimsherds and one hundred and four bodysherds found in Area 4 have been grouped together on the basis of tempering, color, paste texture and surface treatment. These features in combination are very distinctive, the sherds are easily sorted from other material and there can be no doubt that they represent a single vessel. Sherds are very small, paste texture and fracture are not conducive to re-fitting and we have been able to fit only two of the rimsherds and none of the bodysherds. Therefore, no estimate of body shape or size can be attempted. The rim is typical Upper Republican collared, the interior line straight to slightly concave. Lip is rounding and undecorated. The collar, about ⅝ inch wide, has been decorated with parallel-diagonal impressed lines sloping upward to the left. These impressions are indistinct and appear to have been carelessly applied; in places they are nearly vertical, in others nearly horizontal. The groove below the collar (and probably the shoulder area immediately below) shows distinct parallel-vertical cord marks.

Sherds are tempered with a moderate amount of sand, fine to medium in size and evenly distributed. There are also occasional small particles of red ocher in the paste which may, or may not, be natural inclusions. Color of both surfaces and the core is red of various shades. The exterior varies from deep dark red to light orange with most sherds a medium red-orange. A few sherds show grey to reddish-grey exteriors indicative of smoky firing clouds. Color of the interior is, for the most part, a deeper darker red than the exterior, but shades to red-orange on the rim. On some sherds the interior surface shows a thin marked contrast with that of the core and superficially resembles a slip. But no characteristics of slipping (relief, application marks, covering of temper particles, etc.) are present and I feel sure the phenomenon is a result of varying oxidation during firing. The core is mostly bright red-orange except where the exterior has been darkened by sooting or reduction and the grey has penetrated to varying depths. If the clay originally contained carbonaceous matter it was thoroughly burned out.

Body thickness varies from 4 to 7 mm., but the majority of sherds run very close to 5 mm. Surface hardness is about 3. Texture of the paste exclusive of temper appears rather chalky and is very porous. When dry the sherds absorb water very readily and "bubble" for some time when immersed. Breaking strength is not high. Freshly broken edges are moderately irregular but little abrasion is needed to smooth them over and old breaks have comparatively smooth and rounding edges. The interior surface seems to have been fairly well evened but is not tactually smooth. The exterior

was roughened by cord impressions rather lightly applied and occasionally somewhat indistinct. There was little or no smoothing over the impressions.

V 9 (Fig. 5, k; Pl. 8, d)

One rimsherd from Area 5. This rim is collared but the interior line is markedly concave. The sherd represents too small a portion of the mouth circumference to be oriented with certainty but it seems probable that the orifice was slightly constricted. Rim was about 1½ inches high. Lip is rounded and undecorated. The collar, about 1 inch wide, is cord-marked with impressions about 2 mm. wide and more or less parallel-vertical. It is tempered with a moderate amount of medium to coarse sand. Color is dark grey throughout shading to brown at the neck. Paste texture, exclusive of temper, is silty. Surface hardness is about 5. Interior surface of the rim appears somewhat uneven but is fairly well smoothed.

Upper Republican
V 10 (Fig. 5, 1; Pl. 8, e)

One rimsherd, from Area 6, is collared with the interior line nearly straight. Lip is rather thin, rounded and undecorated. Collar is ¾ inch wide and shows very faint, nearly obliterated, parallel-diagonal lines sloping upward to the right. Below the collar cord impressions sloping roughly in the same direction are more distinct. It is moderately tempered with medium to coarse sand. Color of the interior is tan, that of the exterior partly tan, partly grey. Color of the core is medium grey. Hardness is 5.5, paste texture silty.

Upper Republican
V 11 (Pl. 9, c)

One rimsherd from Area 4. This sherd is small and the lip is missing but it seems to be from a collared rim. The collar shows two parallel-horizontal trailed lines applied over faint parallel-vertical cord impressions which continue below the collar. It seems to be totally lacking in temper. Texture is silty, hardness about 4. Color is dark grey throughout shading to buff below the collar on the exterior. Five small bodysherds found in the same Area are similar in paste texture and lack of temper. These are cord-impressed on the exterior, the impressions mostly fine (less than 1 mm.) closely spaced and parallel. They are buff on the exterior, dark grey on the interior and core.

Upper Republican
V 12 (Fig. 5, m; Pl. 9, b)

One rimsherd from Area 16. Rim is short — about 1 inch high — and collared. Collar is ⅝ inch wide. Lip is thin, rounded and undecorated, interior line is straight. There is no decoration and all surfaces are smoothed. Two or three particles of medium sand are visible on the edges but the sherd may be classed as untempered. Paste texture is silty, hardness about 5. Color is medium to very dark grey throughout.

Upper Republican
V 13 (Fig. 5, n; Pl. 9, d)

This fragment from Area 5 is wedge-shape in profile and seems to be from the upper part of a collar. It is decorated with 4 deeply incised parallel-horizontal lines 1 to 2 mm. wide, 2 mm. deep and spaced about 2 mm. apart. It is broken along the center of the lowest line — there may have been more lines below. Tempering is moderately sparse and consists of medium to very coarse sand. Surface hardness is nearly 6, paste texture more silty than smooth. Color is blackish shading to grey-buff. Interior surface is tactually smooth and has a slight luster.

Upper Republican
V 14 (Fig. 5, o; Pl. 7, d)

This assembly was made up from two rimsherds and two bodysherds found in Area 5. One other small bodysherd does not fit but seems to belong to the pot. The rim is Upper Republican collared, about 1¼ inches high, with the interior line somewhat curving. The lip is rounding and undecorated. The collar is about ⅝ inch wide and shows parallel-vertical impressed lines but they are almost obliterated by over-smoothing. Paddle marks running horizontally are visible on the interior surface of the rim. Mouth diameter can only be roughly estimated but probably was in the neighborhood of 5½ inches. Shoulder was rounding, maximum body diameter probably between 9 and 10 inches.

Tempering is moderately sparse, consisting of medium to (rarely) very coarse sand. Color of the core and interior surface is uniformly very dark grey — nearly black. Exterior color is also dark grey on the rim and neck area but tan on the shoulder. This tan color is very shallow and contrasts sharply with the dark core; most probably it is a result of surficial

oxidation of iron in the clay. The dark core and interior indicates a carbonaceous clay, unoxidized in firing.

Surface hardness is about 6. Paste texture, exclusive of temper, is grainy and silty. Breaking strength is fairly high, fracture slightly irregular. Interior surface is uneven and not very well smoothed. Exterior seems well evened and is roughened by cord impressions about 1 mm. in width, closely spaced The impressions run vertically below the neck but begin to crisscross in the vicinity of the shoulder line. There are minute parallel impressions in the bottom of the marks, indicating a fibrous cord. There is some smoothing over the cord impressions.

V 15 (Fig. 5, p; Pl. 5)

Four rimsherds and fifteen bodysherds of this vessel were found rather widely scattered in Area 4 but all except one small bodysherd will fit together. Four other bodysherds from the same Area that fit each other are similar in composition and surface treatment and may belong to this pot but do not fit onto the partial restoration.

This rim is also collared, about 1 inch in height above the neck. The interior line is very slightly concave. Lip is thin, more flat than rounded, and undecorated. The collar, which is uniformly 9/16 inch wide, shows lightly-impressed parallel-vertical lines. In places there are rather crude thin incised (or trailed ?) lines running diagonally over the impressed lines. The lower border of the collar has been pinched sharp and notched, leaving a straight row of tapered, often pointed, projections spaced about 7 mm. apart. Immediately above each projection there is a short narrow mark, more or less distinct, which seems to be a fingernail imprint. Several projections show fingerprints on the lower side.

Mouth diameter was about 5½ inches. Maximum body diameter seems to have been at about 4 inches below the lip and was probably near 10 inches. Shoulder is rounded. The area between shoulder line and neck appears rather flat, making a twenty-five degree angle with the horizontal. Height or shape of the lower body cannot be estimated.

Tempering consists of medium to coarse sand and is rather sparse. Body thickness varies from 2 to 5 mm., averaging about 4 mm. Surface hardness is between 5.5 and 6, paste texture silty. Breaking strength is high, fracture lines tending to be more straight or curving than irregular. Color of the core and interior is nearly black. Exterior color below the collar is tan. On the collar one section of the rim is dark grey, another light tan.

Below the shoulder there is evidence of a dark brown firing cloud. (The four bodysherd assembly previously mentioned is dark brown to blackish on the exterior). A small sherd of this pot was re-fired for a considerable length of time in an oxidizing atmosphere. The exterior, already partially oxidized, turned a clear pink but the core and interior retained greyish tones, indicating that the clay was ferruginous but contained considerable carbonaceous matter requiring a long firing period to burn it out.

The interior surface was fairly well evened and smoothed but does not have a slick feel. The exterior was very well evened, possibly by scraping, though any scrape-marks would have been hidden by the cord-roughening. The cord impressions are about 1 mm. wide, closely spaced, and in the neck area run vertically. On the rest of the body, as far as the restoration extends, the impressions are more or less parallel-diagonal, sloping upward to the left. On the four sherd assembly, which, if it belongs to this pot is undoubtedly from the lower body, the impressions are markedly criss-crossed. In places the cord marks were slightly over-smoothed.

This vessel and V 14 are all but identical in color, tempering, paste texture and hardness and were most probably made from the same kind of clay and fired under similar conditions. They are also similar in rim shape and surface treatment and both can be considered as "classic" Upper Republican pots.

V 16 (Fig. 5, q; Pl. 8, h)

One rimsherd and two bodysherds that fit together were found in Area 1. The rimsherd is only about 1¼ inches wide which makes orientation a problem but it seems probable that the rim was moderately flaring. It is about ⅞ of an inch high; the lower half is straight, the upper curves inward. Mouth diameter was probably around 6 to 7 inches, neck diameter ¾ of an inch less. The upper body appears to have been rather steeply-sloping . Lip is flat and undecorated. Immediately below the lip and running parallel to it is a series of shallow linear impressions about 7 mm. long and 1 mm. wide, closely spaced end to end. Below this there is a line of modeled figures with marked relief resembling elongate reverse "lazy" S's. The figures are 16 to 18 mm. long, about 1.5 mm. wide and cover a band 6 to 7 mm. wide on the rim. They appear to be shaped from the clay of the rim rather than applied fillets (if applique they were perfectly welded) and are very neatly made. The upper (left) ends of the reverse S's overlap the lower (right) ends 4 to 6 mm. The surface of the figures are slightly flattened, and while they are not even, their average plane makes an approximate 60 degree angle with the estimated horizontal. Viewed in profile the rim appears to be collared and apparently the figures were modeled on a narrow (7/16 of an inch) collar.

Tempering is very sparse and consists of medium to very coarse sand. Exterior color is dark brown shading to tan, interior is greyish-tan. Color of the core is light blue-grey. A tiny chip from one of the sherds turned pinkish when re-fired in an oxidizing atmosphere and from other experiments I am inclined to think that the grey core is due to reduction of ferric oxide in the clay rather than to non-oxidation of carbonaceous material. Body thickness is 3 to 4 mm. Hardness is 5.5 to 6, paste texture rather smooth. Interior surface is even and well smoothed; in spite of numerous paddle marks it has a slick feel and a slight luster. The exterior is less well evened — at least in the neck area — and is cord-roughened. The impressions are not very distinct but appear to be 1 mm. or less in width and criss-cross markedly. There is no over-smoothing in evidence.

Tempering and surface treatment of this pot are characteristic of Upper Republican but, as far as I know, model designs on the rim have not been reported for that aspect, nor for any other in the High Plains area.

V 17 (Fig. 5, r; Pl. 9, e)

One rimsherd from Area 2. This seems to be from a slight variant of the collared variety of rim. The interior line is slightly convex, the collar less thick at the lower margin than is usual with the collared rims, and the groove is much less obvious. It was apparently about 1 inch high, the collar about ½ of an inch wide. Lip is undecorated, more flat than rounded and has a slight bead on the outer edge. The collar shows diagonal cord marks sloping upward to the left. It is very sparsely tempered with coarse to very coarse sand. Interior and exterior color is buff, core is grey. Paste texture is silty, hardness about 4. Interior surface is fairly well smoothed and evened.

V 18 (Pl. 9, g)

Two rimsherds from Area 9. These are evidently fragments of a rim similar to V 17. They widen gradually downward from a flattened, slightly beaded lip but are broken above the lower edge of the collar. They show irregular but vaguely vertical cord impressions on the exterior surface. There are also the beginnings of single diagonal trailed lines but no pattern can be distinguished. Tempering is moderately sparse, consisting of coarse to very coarse sand. Color of the interior and core is grey, that of the exterior buff. Paste texture is silty, hardness little more than 3. The interior surface is very uneven and poorly smoothed.

V 19 (Fig. 5, s; Pl. 9, i)

One rimsherd from Area 2. This sherd is small but evidently from a straight direct rim. The lip is squared and has diagonal impressions, very neatly applied, spaced about 8 mm. apart and sloping inward to the right. The rim was decorated with broad round-bottomed incised lines running parallel and horizontal at intervals of 4 mm., applied over vertical cord impressions. There are two of these lines and evidence of a third on the lower edge of the sherd. A few grains of coarse sand are visible but they are extremely scarce. Color of both surfaces is a clear orange-buff, that of the core medium grey, evidently a case of rapid surficial oxidation of iron in the clay. Hardness is about 5, thickness 4 to 5 mm. Paste texture is silty. Interior surface is tactually smooth with a slight luster.

This sherd was associated with several from V 4 and the two vessels probably belong to the same cutural complex.

V 20 (Fig. 5, t; Pl. 9, h)

Three rimsherds from Area 5. These sherds are from a straight direct rim with a mouth diameter estimated at 3 to 3½ inches. Lip is squared and undecorated. On the exterior, beginning at 6 mm. below the lip, there is a series of three parallel-horizontal lightly-incised lines, spaced about 3 to 4 mm. apart. The upper line is interrupted for a short space at one point, the other two are continuous as far as the sherds extend. Approximately ½ inch below the bottom line another series of similar lines begins but the sherds extend only a little past the second line of this series. Medium to coarse sand was used in moderate amount for temper. Exterior color is medium grey-brown, interior is grey-brown shading downward to grey. Color of the core is dark grey. Paste texture is more silty than smooth. Hardness is about 5.5, thickness 5 mm. Interior surface is slightly uneven and not very well smoothed, the exterior more even and well smoothed.

This rim is similar in many respects to V 19 and probably belongs to the same group.

V 21 (Fig. 5, u; Pl. 9, f)

One rimsherd from Area 8. This sherd has only a small part of the rim present and the lip is missing from that. It cannot be accurately oriented but the rim curves outward and was undoubtedly more or less flaring. It was also short, probably extending no more than ½ inch from the neck. A rather small vessel is indicated. The rim shows parallel-vertical cord impressions about 1 mm. wide, possibly made with a two-strand twisted cord. These continue to about ⅜ of an inch below the neck but are all but obliterated there by three lightly trailed lines, closely spaced, roughly parallel and horizontal. Below these the cord impressions are parallel-horizontal, deeper, and pretty definitely made with a two-strand cord. Tempering is coarse sand, rather sparse, and there are occasional particles of red ocher in the paste. Exterior color is buff, interior dark grey. Core is tan on one edge, grey on the other. Texture is silty, hardness about 3. Body thickness varies from 7 mm. at the neck to 3 mm. at a point ⅝ inch below, which is as far as the sherd extends.

V 22 (Fig. 5, v; Pl. 9, j)

One rimsherd from Area 4. The smallest rimsherd yet found at the site, undoubtedly from a miniature vessel. Rim was apparently straight and direct, lip flattened with a small interior bead and undecorated. Exterior shows traces of cord impressions about 1 mm. wide. Coarse sand temper is very sparse. Color is dark grey throughout. Thickness is 2 to 3 mm., hardness about 4, paste texture silty.

V 23 (Fig. 5, w; Pl. 9, k)

One rimsherd from Area 7. This small sherd seems to be from a replica in miniature of V 15. It is collared, with straight interior line and pinched and notched lower border. It was about ½ of an inch in height, the collar about ¼ of an inch wide. There are faint vertical cord impressions on the collar. Only a short arc of the original mouth circumference is present but mouth diameter was probably not over 3 inches. It is tempered with a moderate amount of fine to medium sand. Color is reddish-tan on the exterior, dark grey on the interior, with the core about evenly divided between the two colors. Hardness is not quite 3, paste texture silty.

V 24 (Fig. 5, x; Pl. 9, l)

One rimsherd from Area 5. This rimsherd is among the smallest from the site but is the most intricately fashioned and rather difficult to describe. It is broken at the neck but was apparently about ⅝ of an inch high. Mouth diameter can be only roughly estimated but was probably between 3 and 4 inches. It may perhaps be best described as basically collared with a slightly S-shaped interior line. There is evidence that the collar, about ⅜ of an inch wide, was formed by welding a roll of clay around the exterior of the rim. Approximately midway between the lip and the lower edge of

the collar there is a line of deep sharp impressions about 3 mm. long, closely spaced end to end and running parallel to the lip. The area between this line and the lip is divided by similarly deep sharp impressions running vertically between the horizontal line and the lip. These are spaced at about 3 mm. intervals and together with the horizontal impressions form a series of nearly square sections with considerable relief. The area between the line of horizontal impressions and the lower border of the collar is filled with parallel-diagonal incised lines sloping upward to the left, spaced about 4 mm. apart.

After this decorating was done a thin flap of clay at the lip was folded outward over the collar, reaching to, or slightly past, the line of horizontal impressions and covering the squared sections on the upper half of the collar. The flap was gently pressed down. welded only at the lip. A short section of it was broken off while the sherd was being washed, which disclosed the network of lines beneath. This flap had the effect of giving an otherwise typically collared rim a relatively broad rounding lip. The lip has also been decorated with parallel-diagonal incised lines, spaced and oriented the same as those on the edge of the collar.

It was very sparsely tempered with coarse to very coarse sand. Color is a pale red-orange throughout. Hardness is about 4, thickness at the neck is 2 mm. Paste texture appears more smooth than silty. The interior surface is a bit uneven and not very well smoothed. The exterior shows faint cord impressions below the collar.

V 25 (Fig. 5, b; Pl. 6)

Eight rimsherds and one hundred and thirty-six bodysherds (small to very small) of this pot were found in Area 7. All of the rimsherds and forty-six of the bodysherds have been reassembled into a restoration of about ⅓ of the rim and the adjoining parts of the upper body. Height of the vessel cannot be guessed; greatest body diameter was a least 9 inches and mouth diameter about 5 inches. The shoulder area is steeply-sloping, the neck merely the point of maximum constriction. The rim is the same thicknes as the body and curves and flares slightly. The inner surface tapers to a thin lip which is decorated with a series of short parallel-diagonal impressions spaced 6 to 8 mm. apart, neatly applied on the inner (tapered) surface.

It is tempered with a moderate amount of fine to medium rounded sand. Particles up to granule size are present but rare. One small bit of calcite was observed. There is also a considerable amount of mica in the paste, thin platy particles ranging in size from microscopic to occasionally

3 mm. in length. Those on the surface commonly have a parallel alignment with the surface (probably due to the smoothing operation) and reflect light markedly, giving the sherds a spangled appearance. Whether the mica was an added or a natural inclusion cannot be determined except by petrographic analysis but in view of the fact that sand was added I am inclined to think that the clay — or possibly the sand — was naturally micaceous.

Color of both interior and exterior surfaces shades from light grey through medium grey to deep black. Soot encrustation is rare — very little was noted when the sherds were washed. On the partial restoration several instances occur on the interior surface where one sherd in light grey and the adjoining one is black, the fracture line marking a very sharp contrast. This would appear to be due to post-breakage factors. On the exterior, particularly in the neck region, there are small areas that show a sort of thin surface scum, grey to grey-bronze in color. This has no relief, does not obscure the mica particles and will not wash or scrape off. It also is often sharply delimited by fracture lines. Color of the core is dark grey to black. Sherds of this pot turned red-orange when re-fired to a moderate temperature in open air, indicating that the clay contained considerable iron oxide.

Surface hardness is about 4. Sherds are uniformly thin, 3 to 4 mm. Breaking strength is high, considering thinness of sherds, and fracture lines are rather straight and regular. Paste texture is grainy and slightly porous. Finishing technique seems to have been identical for both interior and exterior surfaces. In fact, except for curvature it is often impossible to determine which side of a sherd was the outside. Minor bulges and depressions indicate that thinning and evening were done with a paddle and anvil rather than by scraping. Particles of the sand temper protrude slightly but are rarely bare. This is probably due to drying-shrinkage. Surfaces are rough though not abrasive. Other than the impressions on the lip the sherds show no attempt at decoration.

Just below the neck there is a fairly definite ridge running parallel with the rim and extending the full width of the restored section. Some fracture lines run parallel with the rim and a few of these have concave edges though they are not particulary smooth. These features seem to indicate that the pot was built by coiling, but they are not definite enough to warrant a positive conclusion.

Micaceous sherds previously reported from the Central Plains have been associated with the Dismal River aspect but in all instances have been in a definite minority. At the Lovitt site in Chase County, Nebraska, mica-tempered sherds made up less than one percent of the total sherd count

(Hill and Metcalf 1941: 180). Champe (1949: 288) mentions finding one mica-tempered sherd at White Cat Village, a Dismal River site in Harlan County, Nebraska. George Metcalf (personal communication) says that the Coal-oil sherds are very similar to the mica-tempered sherds from Lovitt but that both are very similar to micaceous Upper Rio Grande utility wares. As far as I know there is no mica, micaceous clay or comparable micaceous sand in this part of the country so it seems probable that V 25 was carried in from some distance. Who the carriers were cannot be positively demonstrated on present evidence. No other definitely Puebloan or Dismal River cultural material has been found at the site as yet.

V 26 (Pl. 11, a)

Five (?) rimsherds and about sixty bodysherds from Area 1. This material is about as crumbly as pottery can get and still be worthy of the classification. It is moderately to heavily tempered with sand and bits of mortar-bed. The sand, which comprises less than one-third of the temper, is coarse to very coarse. The mortar-bed fragments range from fine particles of silty calcium carbonate to pebbles of calcareous sandstone up to 5 mm. in size which themselves contain grains of fine to medium sand. Paste texture, exclusive of temper, is silty and grainy. Apparent overall texture of the sherds is very coarse and crumbly. Fine checks and cracks show on all surfaces and throughout the core. Surface hardness is about 2.5. Breaking strength is very low and fracture highly irregular. Most sherds are very small. Color is light reddish-grey to bright red-orange throughout, with many sherds showing a red to dark red interior surface. Body thickness apparently varied from 3 to 8 mm. The vessel was undoubtedly lump modeled with very careless workmanship.

One sherd is definitely from a rim, apparently straight and direct with rounded undecorated lip. Four other sherds show what seem to be sections of lip but are very uneven and poorly shaped. If all are rimsherds and all from a single vessel, which seems likely, lip thickness varied from 2 to 5 mm. Both interior and exterior surfaces are extremely uneven and carelessly smoothed, with no evidence of decoration. Fingerprints show occasionally on both surfaces and some sherds show surface impressions of grass leaves, roots or tiny twigs. Several sherds are sharply angular, indicating either a flattened base or an angular shoulder, most probably the latter.

These sherds definitely indicate a decadent ceramic industry and George Metcalf (personal communication) believes they may well be historic Pawnee.

Miscellaneous Bodysherds

This group is composed of four hundred and thirty-six bodysherds, mostly small — some very small — that cannot be related to any of the rims, give little or no clue to body shape or size and therefore would not repay detailed description. All are tempered with sand but amounts vary from heavy to practically none. Most are cord-marked on the exterior surface with impressions ranging from fine (less than 1 mm.) and closely spaced to broad (up to 3 mm.) and spaced at intervals up to 5 mm. The impressions range from deep and sharp to shallow and indistinct. The majority of sherds show little or no smoothing over the cord marks but on some the marks are nearly erased. A few sherds are plain, or nearly so. Thickness varies from 2 to 9 mm., hardness from less than 3 to nearly 6. In color most sherds are some shade of grey or brown but some have tan or buff surfaces with grey cores and a few are red-orange throughout. I can find no definitely recurring combinations of any of these traits, with one exception: nearly all the thickest sherds are moderately to sparsely tempered and either plain or show coarse, widely-spaced and nearly erased cord impressions.

One group of forty-eight bodyherds found in Area 2, pretty definitely from the same pot, deserves mention. They are moderately tempered and show occasional white flaky particles of (probably) gypsum in the paste. The exterior surface is cord-marked, impressions are about 1 mm. wide, spaced 3 to 4 mm. apart with a little over-smoothing. One sherd, from just below the neck, is abruptly and markedly thickened immediately below the neck, strongly suggesting a handle. Two of the sherds have conical holes tapering from 7 mm. in diameter on the outside to 3 mm. on the inside, drilled after firing, probably for lacing to repair a crack.

I have made several more or less abortive attempts at sorting this group of sherds into individual vessels and have found that it is a very exasperating job. Color is not a reliable criterion in most cases since uneven and partial oxidation, sooting and smudging in spots, etc., can result in a wide variety of colors on the same pot. Amount of temper is helpful if evenly distributed and surface treatment is dependable within certain limits. Thickness is only occasionally reliable. Perhaps the most consistent characteristic of any one vessel is paste texture exclusive of temper, but this feature varies little in this group of sherds and is not often helpful.

Using various combinations of these traits as criteria, I have made several sorts and invariably came up with over one hundred different vessels, most represented by less than half a dozen sherds, many by only one. I must admit to being a "splitter" by nature with a better eye for the trees than

the forest, but feel that this number cannot be greatly reduced without an unconscionable amount of forcing. I believe that the most ultra-conservative estimate within reason would be in the neighborhood of sixty-five to seventy vessels.

Probably most, if not all, of these sherds would fit somewhere within the limits of the Upper Republican aspect, but surely more than one focus is represented.

Questionable Ceramic Material

These one hundred and thirty-three fragments of baked clay are at present something of a problem. The unifying characteristics of the group are extreme surface uneveness, variation in thickness and general irregularity of shape as contrasted with the usual run of potsherds. Nearly all are some shade of reddish-buff, red-orange or red, but a few show areas shading to grey. All pieces are small, ranging from "buckshot" size up to (rarely) 1½ inches.

On bases of temper and texture the material may be divided, with some intergrading, into four groups. Group 1 (Pl. 11, b) has, for the most part, no non-plastic inclusions though an occasional grain of sand or particle of mortar-bed may be present. Hardness ranges between 5 and 6, paste texture is smooth and flaky. This material seems to be local Tertiary clay that was gathered in moist plastic condition and shaped with no mixing and little working. The mottling and lamination of colors characteristic of the Tertiary clay are still present in most fragments with little alteration. Group 2 (Pl. 11, c) is also lacking in temper except for a few grains of sand or mortar-bed but is made of coarser-grained material and is rather rough-textured. Hardness runs from 3 to 4. Group 3 (Pl. 11, d) differs from Group 2 only in having considerably more "temper" which consists almost entirely of bits of mortar-bed. Actually, there is considerable intergrading between Groups 2 and 3 with several pieces intermediate between the two. Group 4 (Pl. 11, e) is entirely lacking in temper. It has a very silty texture and averages little more than 2 in hardness. From firing experiments I would guess that this group was made from local Peoria loess.

At least a few pieces of this material were found in almost every Area of the site, with the heaviest concentrations in Areas 1, 2 and 4. A little of it may be no more than "doodles" of clay, more or less accidently fired. Two or three pieces are somewhat nodular in shape and may possibly be fragments of lugs, handles or effigies. Two are thick and suggestive of pot lids. Many, perhaps most, might be potsherds from irregularly shaped, poorly evened and smoothed vessels of the decadent Pawnee variety. But

some of them seem altogether too irregularly shaped to have been part of any kind of vessel though they nonetheless give the impression of having been shaped for some purpose. And, since the latter are present in all four texture groups and grade by imperceptible degrees into the possible potsherds, it seems best at present to group them all in a sort of catchall category in the hope that further work will shed some light on the problem.

Work In Chipped Stone

Twelve hundrd and sixty-eight chipped stone artifacts were found at the site during the preliminary testing. A wide variety of stone is represented, both in the artifacts and in the vast quantities of chips, flakes and cores, nearly all of which could have been obtained within a dozen or so miles of the site. Gravel deposits containing cobbles and small boulders are common in Wallace and Logan Counties in the area lying between Smoky Hill River and the north fork of that stream. The rounded stream-worn stones in these deposits were carried down from the Rocky Mountains during Pliocene or Pleistocene times and make up a seemingly endless variety of rocks. Elias (1931: 177) says, "The regular round stones of the gravel are made chiefly of various kinds of igneous and metamorphic rocks, among which were recognized granite of various kinds, pegmatite, various porphyries, basalt, quartz (rock crystal, colorless and smoky), flint, jasper, quartzite and other hard rocks."

But, to the Indian in search of chipping material — and the archeologist attempting to follow his trail — the rocks fall into two broad groups: the homogenous, relatively smooth-textured material with concoidal or semi-concoidal fracture which can be shaped and sharpened by flaking, and the grainier, rough-textured stones with irregular fracture (such as the granites and porphyries) which cannot. Our reconnaissance of some of the gravel beds showed that while good chipping material makes up a small percentage — probably less than five percent on the average — of the total rocks, it is fairly plentiful. It varies somewhat from area to area but in most deposits one person can gather a considerable amount in a short time. However, the finest grades of flint, jasper, etc. — homogenous, isotropic and with perfect concoidal fracture — are pretty rare, probably constituting less than ten percent of the usable chipping material. The materials used in the chipped stone artifacts from 14L01, as well as those from other sites in Wallace and Logan Counties, can almost invariably be found in these gravel beds and it seems very likely that they were the source of the chipping material. An occasional finished artifact — usually an arrowpoint — is found in these gravel deposits but chips, flakes or flaked cores are very rare and it seems probable that the rocks, which average smaller than fist-size, were carried to the various sites for working.

The chipping material from 14L01, rejectage as well as artifacts, also falls more or less readily into two broad groups: the isotropic, homogenous, tactually smooth rocks with few flaws and good concoidal fracture, and the more grainy material with semi-concoidal fracture. With some selection in classes which is noted later, the artifacts are about equally divided between the two groups, which probably reflects the comparative scarcity of the better grade of material in the gravel beds.

The most distinctive single kind of rock used at the site is the black, compact, nonporphyritic basalt. Approximately thirteen percent of the total chipped artifacts were made from it. Grading from slightly grainy to almost glassy in texture, it has a semi-concoidal fracture and is relatively easily flaked. It does not, however, "hold an edge" well and breaks fairly easily. At 14L01 it was used mostly for side scrapers and flake knives but shows up in every chipped artifact class except choppers and forms a large percentage of the rejectage. Most artifacts made from it are not well chipped but an occasional very well-made tool turns up. The basalt occurs in about the same relative abundance in all known aboriginal sites in Wallace and Logan Counties, ranging from pre-ceramic through proto-historic. It might perhaps, pending further study, be considered an area-diagnostic.

The white chert and opal-like material which occurs locally in the upper zones of the Ogallala formation were used rarely by the occupants of the site. The chert is a valuable chipping material but almost invariably occurs in lenses or nodules too small to be used. The opal material is very hard but is almost always badly flawed and often seems to shatter easily. It was used mostly for choppers or crude scrapers at 14L01 with uniformly poor workmanship.

Perhaps a word of explanation concerning classification and nomenclature should precede the description of the chipped stone artifacts. Probably the best way of organizing the non-ceramic artifacts in a collection such as this is a primary division into kinds of material and a secondary division based on function, with minor subdivisions on bases of form, technique, etc. But, apart from the dangers inherent in projecting the nomenclature of one culture onto the tools of another, there is often a real difficulty in determining just what job a given artifact was made — or used— for. In some cases there is an obvious inference: a thin blade with very sharp edges is a cutting tool in anyone's language — a "knife" in ours. Similarly, a well-made but thicker tool with dull edges most probably was used for scraping. An artifact with a long narrow pointed stem would be all but useless for anything but punching or boring holes. Small well-made points were obviously hafted to projectile shafts — undoubtedly arrowshafts in the later, ceramic complexes. And so on. But halfway between the obvious cases are those "borderliners" which show characteristics of two — sometimes more — classes. A blade, for instance, with a sharp edge on one side, a dull one on the other. A small triangular object with a point narrower than the arrowpoints but duller than the drills. A tool which by coarseness and irregularity of its edges resembles the choppers but is thinner and lighter than some scrapers. (And at just what point in size and weight does a "point" become a knife, or a spear tip, rather than an arrowpoint?)

At times during the study of this collection it seemed that there were artifacts grading by imperceptible degrees from any one class to every other class, leaving those which, as Lehmer puts it so well, "balance hesitantly between two groups, awaiting the impatient shove which assigns them to one or the other." Two other temptations also arose: to set up "sub-subclasses" for the variants, or, particularly in the cases of broken or poorly-made objects, to dump them in the "Oddments" pile. The latter could too easily grow into a habit resulting in loss of information, and to succumb to the former would be to bog down in a morass of minutiae. A middle course was attempted and the resulting classes, names and presumed uses which follow are presented as one man's considered opinion and not as categorical verities.

Arrowpoints

By far the most numerous stone artifacts are arrowpoints. A total of six hundred and fourteen has been found, of which one hundred and forty-five are complete and two hundred and ninety-one more are sufficiently so to be grouped according to form. There are one hundred and seventy-eight fragments which are readily classifiable as arrowpoints but are too incomplete to be assigned to a group. These have been included in the total count of arrowpoints. Not included in the count are forty-two specimens (Pl. 12, p) which, while resembling one or more of the groups in size and outline, seem rather too crude to have served efficiently as arrowpoints and are probably unfinished points. Several of them, exhibiting such features as fine overall chipping, a notch on one side and broken base (Pl. 12, q) were evidently broken in manufacture. Also not included in the arrowpoint count are twenty-four small subtriangular objects which might be arrowpoint blanks (Pl. 12, r). They have been roughed out by primary chipping to the approximate shape and size of an arrowpoint but are altogether too crude to have been hafted to an arrowshaft. Harder to classify are twenty-four small artifacts (Pl. 12, s). All are triangular and most are shaped from very thin flakes with some retouching on all edges. Six have rudimentary side notches — three with base notches as well — and in outline they resemble somewhat the smaller arrowpoints. But they are undoubtedly too small and crude to have been used as

arrowpoints and the purpose for which they were made is conjectural. They may be the work of children or they could have been used for etching or incising.

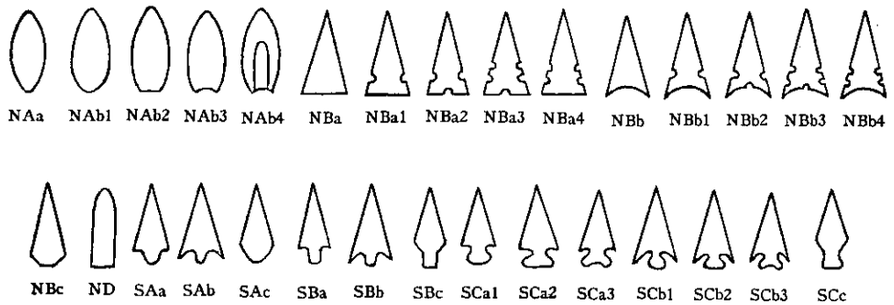
The four hundred and thirty-six arrowpoints which are complete or sufficiently so have been divided into thirteen groups following a system (Fig. 6) employed by Strong. This system (Strong 1935: 88-9) has been modified for the purpose of this report by the addition of Groups NBb3 and NBb4.

Group	Number	Size Range (millimeters)	Typical
NAb2 (Pl. 12, a)	22	39 x 22 - 17 x 11	33 x 17
NBa (Pl. 12, b)	148	40 x 21 - 16 x 10	30 x 18
NBa1 (Pl. 12, c)	70	36 x 15 - 14 x 11	26 x 14
NBa2 (Pl. 12, d)	53	30 x 17 - 18 x 12	25 x 14
NBa3 (Pl. 12, e)	6	2 complete: 28 x 17 - 21 x 16	
NBa4 (Pl. 12, f)	10	37 (est.) x 18 - 19 x 15	23 x 15
NBb (Pl. 12, g)	47	35 x 19 (est.) - 15 x 10	26 x 16
NBb1 (Pl. 12, h)	53	42 (est.) x 13 - 17 x 13	29 x 15
NBb2 (Pl. 12, i)	9	43 (est.) x 17 - 28 x 15	29 x17
NBb3 (Pl. 12, j)	3	1 complete: 39 x 19	
NBb4 (Pl. 12, k)	6	2 complete: 39 x 20 - 24 x 14	
SCa2 (Pl. 12, l)	7	33 x 20 - 20 x 14	28 x 15
SCb2 (Pl. 12, m)	2	27 x 17 (est.) - 22 x 15	

The stemmed forms are, in general, well made but lack the long, narrow ribbon-like flake scars usually found on the better-made specimens of the unstemmed groups. Small stemmed and barbed points are considered more or less characteristic of the Plains Woodland peoples; the other stemmed points from 14L01 have little diagnostic value.

Small triangular unstemmed points, both notched and unnotched, seem to have been made by many, if not most, of the later prehistoric and proto-historic occupants of the Central Great Plains. Judging from the relative amounts of pottery found at the site it seems probable that most of the unstemmed arrowpoints belong to the Upper Republican occupations.

There is considerable variation among the unstemmed points in both quality of material used and quality of workmanship. The former varies from poor to excellent and the latter from shabby to really beautiful. A



N. — Not Stemmed

A. Leaf-shaped
- a. Pointed at both ends
- b. Pointed at one end
  - 1. Convex base
  - 2. Straight base
  - 3. Concave base
  - 4. Concave base, longitudinal groove

B. Triangular
- a. Straight base
  - 1. Two side notches
  - 2. Two side notches, one base notch
  - 3. Four side notches, one base notch
  - 4. Four side notches
- b. Concave base
  - 1. Two side notches
  - 1. Two side notches
  - 2. Two side notches, one base notch
  - 2. Two side notches, one base notch
  - 3. Four side notches, one base notch
  - 3. Four side notches, one base notch
  - 4. Four side notches
- c. Convex base

D. Straight sided, pointed at one end

S. — Stemmed

A. Contracting stem
- a. Shouldered
- b. Barbed
- c. No shoulder, no barb

B. Parallel sided stem
- a. Shouldered
- b. Barbed
- c. No shoulder, no barb

C. Expanding stem
- a. Shouldered
  - 1. Convex base
  - 2. Straight base
  - 3. Concave base
- b. Barbed
  - 1. Convex base
  - 2. Straight base
  - 3. Concave base
- c. No shoulder, no barb

Figure 6. Form classification for chipped points. (After Strong, W. D.)

study was made of these forms in an attempt to discover any possible relationship between shape, size, quality of workmanship or kind of material, which produced some interesting results. Size was found to vary considerably more within each group than between groups and both extremes of workmanship occurred in all groups and size ranges, but a definite difference existed between the notched and unnotched forms in quality of workmanship and material. With some notable exceptions the neatest chipping and most symmetrical forms were associated with the finer-grained least-flawed material, which might be expected, but in general the notched points were made of somewhat better material and were decidedly better made. Thirty-six percent of the unnotched points showed overall chipping on one side only indicating that they were made from thin flakes requiring less chipping to shape them, while only nine percent of the notched points were thus made. The basalt, undoubtedly an inferior material for arrowpoints, was used for twenty percent of the unnotched forms as against eleven percent of the notched. Judgement of quality of workmanship is admittedly arbitrary and difficut to reduce to statistics, but my count of the "excellent" points produced a ratio of seventeen percent for the unnotched to forty percent for the notched. There was also a noticeable trend in workmanship among the notched forms themselves. Although there is no neat, orderly progression there is a general tendency for the points with the most notches to be the best made. This was noticed even during excavation and has been borne out by detailed study.

Such variations within an artifact class are of considerable interest and create temptation to indulge in unfounded speculation. Elaborately and well-made arrowpoints are often popularly regarded as having been used for "war arrows" or "medicine arrows" and the plainer ones for more utilitarian purposes such as hunting. In such a case a comparison of the numbers of notched points (210) and unnotched points (217) in the unstemmed forms from 14L01 would seem to indicate that the occupants were as well prepared for war or ceremony as for making a living. There is, however, no archeological evidence whatsoever indicating that either the Upper Republican or Dismal River peoples were inordinately warlike. And if breakage is a valid criterion of use the notched points were used about as much as the unnotched: sixty-three percent of the notched points found were broken, compared with sixty-eight percent of the unnotched. To me it seems at least as probable that the multi-notched arrowpoints, which seem to occur along with unnotched points in several cultural complexes, might be an intra-tribal fashion, possibly with some connotation of personal aggrandizement and carrying social prestige, somewhat on the order of the elaborate automobiles of our own culture. There is no evidence at 14L01 that they were used for different purposes than the unnotched points.

Large Points

A number of points seem too large to have served as arrowpoints. Of the eleven which are complete or nearly so eight are NBa (Pl. 12, 0) and three are SCa2 (Pl. 12, n). The largest measures 54 by 30 mm., the smallest 40 by 27 mm. Workmanship varies from poor to excellent. In addition there are thirty-one tip fragments which by shape, size and flaking seem safely assignable to this class. They may have been hafted as cutting or stabbing tools or served as spear tips.

Drills

Including fragments a total of thirty-two drills has been found at the site. They may be roughly divided into two groups with variants of each. Most numerous is a "T-shaped" form (Pl. 15, f-k) with a narrow point, ovoid to lenticular in cross section, projecting from a base of varying shape and size. Only four of these are complete. In most cases the base shows overall chipping but two are thin flakes with little or no chipping (Pl. 15, f). The largest specimen (Pl. 15, k) appears to have seen heavy use. A variant of this group with a side tang is shown in Pl. 15, p, page 78.

The second group is triangular in outline (Pl. 15, l-o). The point is missing in eight of the nine specimens. Two are rather crudely fashioned from splinters of stone (Pl. 15, l) but the remainder are well shaped, three being plano-convex in cross section and four biconvex.

There are three stem fragments and three bases that are too incomplete to be assigned to a group. The T-shaped artifact shown in Pl. 15, q is very well shaped but has a blunt point and is extremely thin, averaging 1.5 mm. in thickness. Its function is uncertain.

Knives

The knives from the site can be grouped into two subclasses, one well shaped with fine overall chipping, the second fashioned from flakes of various shapes and sizes by only a little retouching to sharpen one or two edges. Of the first subclass there are twenty-two complete specimens and thirty-one pieces that are too fragmentary for their original shape to be determined accurately. The complete ones are all well made, thin, worked on both sides and sharpened on all edges. There is considerable variation in size and outline but with a little forcing in some cases they can be placed in six groups:

1. There are two classic samples of the alternately-beveled diamond-shaped "Harahey knife" (Pl. 13, a), both tips of another and four which vary somewhat in minor details, ranging in size from 11.4 by 3.5 cm. to 8.3 by 3.1 cm. The three classics are made of a banded flint, most probably the Alibates flint from the quarry near Amarillo, Texas (Shaeffer 1958: 189-90).

2. Five knives are relatively small and round to oval in outline (Pl. 13, b), the largest measuring 6.3 by 3.2 cm., the smallest 4.3 by 3.4 cm.

3. Two, measuring 11 by 4.6 cm. and 7.2 by 2.7 cm., are ovoid with points on each end (Pl. 13, c).

4. Four knives are pointed on one end with straight to rounding bases and are narrow in relation to length (Pl. 13, d). These range in size from 10.7 by 3.4 cm. to 5.9 by 2.5 cm.

5. Two are subrectangular in outline (Pl. 13, e, f). The smaller, with straight ends and somewhat curving sides, measure 6.4 by 3.8 cm. The other 8.5 cm. long and 4.3 cm. at greatest width, seems to have a stem of sorts, possibly to facilitate hafting.

6. One specimen is triangular (Pl. 13, g) measuring 6.1 by 4.1 cm. There is also a miniature replica of this knife measuring 12 by 16 mm. This tiny artifact is very well chipped and has three sharp edges. Both triangular knives are made of an unusually fine grade of basalt.

The artifact shown in (Pl. 13, h) is beautifully chipped along one side and around the point while the other side and the base are mostly unworked. In appearance it suggests an unfinished knife or large point but it could have served as an unhafted cutting tool in its present form.

Knives made from flakes, or flakes evidently used as knives, may also be divided into two groups. The smaller forms, seventeen in number, are mostly elongate subelliptical in outline (Pl. 13, i) and range ln length from 8.9 to 2.7 cm. with the width roughly ¼ to ⅓ of the length. All have one smooth surface — the natural curving cleavage plane of the flake — while the other side shows varying amounts of primary chipping. Both edges and usually one end show some fine retouching, most of it probably applied, some possibly resulting from use of an already sharp edge.

There are fifty of the larger forms, including fragments, all rather thin (Pl. 13, j, k). They are made from flakes unmodified in outline and are so varied in shape and size as to defy description. All have fine retouching on one or more edges and would make serviceable cutting tools.

Scrapers

Artifacts classifiable as scrapers are numerous at the site and have been divided, according to presumed function, into endscrapers and side-scrapers. The former are particularly abundant, one hundred and sixty-one having been found. All are of the common plano-convex variety, small, triangular or ovate to subrectangular in outline and characterized by one smooth, usually curving cleavage-plane surface and one more or less markedly convex surface sloping up to and culminating in an abrupt edge at the widest end (Pl. 14, h-l). Almost invariably the thick abrupt working edge has been carefully chipped. Many are very well made, with fine overall flaking on the convex side, but some are rather crude, showing rough primary flaking except on the working end. Outline dimensions vary from 4.7 by 2.6 cm. to 2.2 by 1.5 cm. A typical sample measures 3.5 by 2.3 cm. Maximum thickness, usually near the working end, varies from 3 to 19 mm.

A notable characteristic of these tools is the fact that, as a class, they are unquestionably made of better material than any other stone artifact class from the site. Over ninety percent of them are made from the isotropic, smooth-textured rocks as compared with about sixty percent of the arrowpoints. Only two endscrapers are made of basalt; one of these is made of an exceptionally fine-grained grade and both are very well shaped.

Lehmer has subdivided the chipped endscrapers from the stratified Dodd site in Stanley County, South Dakota, into five Groups on bases of form, relative size and chipping techniques (Lehmer 1954: 57-9). He found that "end scrapers show definite typological changes from early to late times" at this site and at others in the Middle Missouri area, with the smaller well-made forms associated with the earlier components and the larger, less carefully shaped ones with the later (Lehmer 1954: 126-7). He has used these typological variations as traits in defining the three Traditions of his Plains Village Pattern, considering the smaller finely-flaked forms characteristic of the Middle Missouri (northern early village) Tradition and the relatively larger ones with coarser flaking characteristic of the Central Plains (southern early village) and Coalescent (late village) Traditions. Of the several cultural complexes Lehmer includes in these three Traditions only one — the Upper Republican (Central Plains Tradition) — is ceramically represented at 14L01. But all five of his endscraper Groups, plus the inevitable minor variations and intergradations (and possibly two or three other Groups as well, depending on one's ability, or willingness, to split hairs) are abundantly represented at the site with the smaller better-made forms somewhat in the majority. This suggests that small plano-convex endscrapers with fine flaking may have been a more widespread trait than Lehmer

indicates. It also seems to cast some doubt on the value of typological variations among chipped stone endscrapers as definitely recurring cultural traits.

As with the knives, sidescrapers from 14L01 have been subdivided into two groups according to the amount of work expended on them. Some have been shaped by overall chipping on at least one side while others are merely flakes with one or two worked edges. There are sixty-nine of the former, including broken pieces. While they are considerably thicker and generally do not show the fineness of chipping that characterizes the shaped knives, most of them are well made. Most are round to elongate-oval in outline, some are subrectangular and a few are triangular (Pl. 14, a-c). They vary considerably in size, ranging from 11.9 by 5.6 cm. to 2 by 1.6 cm.

The flake scrapers, like the knives made from flakes, have no determined shape and vary in size. Some have been worked on two edges but most on one only. Thirty-two have been found.

Blades

Twenty-one incomplete artifacts have been tentatively grouped together and classed as blades. All are well shaped by skillful overall flaking and thin, averaging about 5 mm. at thickest part. Twelve of the pieces are working ends characterized by blunt rounding ends and, in the more complete specimens, tapering sides. In size they range from 6.4 cm. wide and 8 mm. thick to 2.2 cm. wide and 3 mm. thick. The other nine pieces are bases, with tapering sides and straight ends which vary in width from 3.3 to 1.7 cm. The basal fragments have about the same thickness-to-width ratio as the working ends. None of the fragments match exactly but on a basis of shape, size and quality of workmanship it seems probable that all, or most, represent one kind of tool (Pl. 15, a-e). Some of the bases resemble the rectangular knives in size and outline, however (cf Pl. 15, c, d and Pl. 13, e), and until complete specimens are found this class should remain hypothetical for this site.

Most of the working ends show slight to severe battering, indicating that they were used for heavier duty than cutting or scraping. It is possible that they were hafted in some manner and used for digging. Most of the ground around the site is rocky and this would account for the battering as well as for the fact that all the specimens found so far are broken.

Choppers

Fifteen flaked objects, thick, ovoid to subrectangular in outline and characterized by rough primary flaking (Pl. 16, a-c) have been more or less provisionally grouped as chopping implements. They vary in size from 8 by 6.5 cm. to 5 by 3.5 cm. None shows modification for hafting though most probably could have been hafted in some manner. Four show light to moderate battering. Some show little or no sign of use and may be cores or rejectage, though they appear to have been shaped with some purpose in mind. All edges seem too coarse and irregular to have been used for cutting or scraping.

Objects of Unknown Use

Two artifacts (Pl. 16, h) are unassignable to any of the above classes and their use is unknown. Both are oval in outline with one pointed end and are markedly plano-convex in cross section. One surface is a natural cleavage-plane and the other has been chipped where necessary to achieve a nearly hemispherical surface. They measure 6.3 by 4.2 cm. and 5.8 by 3.4 cm.

The object shown in Pl. 16, i is something of a puzzle. It is a very thin flake, unmodified except for four rather deep notches on one edge and one on the other.

Fragments of Chipped Stone Objects

In addition to the classifiable artifacts sixty-seven fragments from the site have been saved. All show various amounts of chipping but are too fragmentary for their original shape or function to be determined. An enormous quantity of chips, flakes and cores was discarded after examination.

Work in Sandstone

Comparatively few sandstone artifacts have been found so far at 14L01. Eleven fragments which show wear on one or both flat surfaces are probably pieces of grinding slabs (Pl. 16, j) and two sandstone manos were found. Fourteen artifacts (Pl. 16, d-g), mostly rectangular in outline and ovoid to subrectangular in cross section, have longitudinal grooves and were probably used as abraders in fashioning articles of bone, wood, shell, etc.

Three have grooves on three sides (Pl. 16, f), the rest on one side only. Only one (Pl. 16, g) could be regarded as one of the kind of arrow

shaft smoothers that are believed to have been used in pairs. This is nearly square in outline and hemispherical in cross section, measuring 3.6 cm. long, 3.2 cm. wide and 2.1 cm. thick. The groove is very slightly smaller at one end, which measures 9 mm. wide and 3.5 mm. deep as compared with 10 mm. wide and 4.5 mm. deep at the other. One rectangular piece of rather coarse, dark brown sandstone, measuring 10 by 9 cm. and about 4 cm. thick, has a narrow, shallow longitudinal groove on both sides. On one side the groove is approximately in the middle, on the other it is about 1 cm. off center. This may have been used for a weight.

Work in Bone

In comparison with other material worked bone has been rather scarce at the site. Only twenty bone artifacts and seven pieces showing cutting or grinding have been found.

There are fragments of five splinter awls (Pl. 17, f, g) and one thin broken object with a small conical hole near one end that may have been a needle (Pl. 17, h). An ulna from a small bison (Pl. 17, a) shows considerable wear at the tip and was probably used as a pick. The proximal end was damaged in excavation so the extent of its modification, if any, cannot be determined. One piece of heavy bone, probably from a bison tibia, which shows wear on the tip (Pl. 17, d) was evidently used as a punch and there is a punch made from the ulna of a small dog or coyote, complete except for tip (Pl. 17, b). The head was modified by breaking off the olecranon process with little smoothing of the resulting rough edges. One incomplete artifact, made from a section of bison rib, has a round biconic hole approximately 15 mm. in diameter through the center (Pl. 17, e). It was probably an arrow-shaft straightener but shows little wear around the remaining edges of the hole. A piece of thick bone unmodified except for considerable use-polish along one edge (Pl. 17, c) was apparently used for scraping.

The small thin bone object shown in Pl. 17, j, is slightly curving both laterally and longitudinally. It is about 4 cm. wide but is incomplete and its original length cannot be guessed. The laterally concave side shows some slight use-polish and the other side has grinding striations. The two holes, 4 mm. and 5 mm. in diameter, near one edge are slightly conical from the polished side. It may be a remnant of a bow guard or an ornament of some kind. A small object, apparently of tooth enamel, thin, narrow and tapering to a rounded point (Pl. 17, k) was probably part of a necklace. It is beautifully formed and finished. At the top it is broken across a small, slightly biconic hole 2.5 mm. in diameter. Immediately below the hole, on both sides, there are shallow indentations as if an attempt had been made to drill a hole. It measures 23 mm. from bottom of the hole to the tip, is 7 mm. wide and 2 mm. thick.

A total of seven tubular bone beads, ranging in length from 14 to 25 mm., were found. Two, cylindrical and thin-walled, are evidently made from bird bone (Pl. 17, q). A somewhat longer section of bird bone, cut off on one end and broken on the other, and the femur of a medium-size bird, cut off just below the proximal end, were also found (Pl. 17, l). The other five beads are made of heavier bone, triangular to squarish in cross section, probably from the metapodials of rather large dogs (Pl. 17, m). Three dog metatarsals, two cut off just below the proximal end, the other cut off above the distal end and scored all around below the proximal end, were also found (Pl. 17, n). A number of unmodified dog metapodials have been found at the site, some under conditions suggesting collection and preservation for some purpose.

The distal end of an antelope metapodial shown in Pl. 17, i, has been neatly cut off. Several nondescript scraps of bone have been found with incised striations on one or more edges but some may be the result of rodent-gnawing.

Work in Shell

Only two artifacts of shell were found. One is a disk bead (Pl. 17, o) about 10 mm. in diameter and 4 mm. thick, with a cylindrical hole 3.5 mm. in diameter. The other piece of shell has been neatly cut to triangular shape measuring 18 mm. (estimate) by 22 mm. and the base ground to a thin edge (Pl. 17, p). One corner is missing.

OTHER REMAINS

Animal Bone

All tests where cultural material was found have produced some bone and in several a great deal has been turned up, some scorched, charred or calcined. Most if it is broken into fragments too small for identification except as to Class. Of the identifiable material the vast majority is bison; fragments of nearly all skeletal parts have been recognized but little of it saved. Other than that of bison all identifiable skeletal material has been collected for future specific identification. Among the forms represented by the more easily recognizable material are, in order of comparative abundance: bison, dog (large), coyote and/or small dog, antelope (and probably deer), turtle

and rabbit. A few fragments of shell, probably of fresh-water clam, are occasionally found.

No recognizable human skeletal remains have been found at the site.

Vegetal Material

With the possible exception of a soft tan substance as yet unidentified which occurs as a thin coating on the interior of many potsherds, no vegetal material definitely assignable to an aboriginal occupation has been found.

Mineral

Pieces of red ocher (soft, earthy hematite) are almost invariably associated with the cultural material, thinly scattered throughout all levels. Yellow ocher (limonite) is also found but less frequently. The ochers occur as irregular shapeless lumps generally less than 2 inches in greatest dimension. A few show smoothed surfaces or rubbing striations but most are unmodified. No concentrations of special significance have been found but the material seems to be most abundant in Area 2, with Areas 1 and 4 next in order.

DISCUSSION

Education has been defined as a progression from cocksure ignorance to thoughtful uncertainty, and in that sense the fledgling diggers at Coal-oil Canyon have received some education. It can almost be said that our comprehension of the history of the site has varied inversely with the amount of dirt moved, and at present about the only Areas in which we are not thoroughly confused are those which have not been tested. So many theories have been conceived and nourished only to be exploded by new information that we have become rather wary of resonant conclusions. Some interpretation of the evidence can be made however, and a few postulations offered with reasonable hope that they will stand up under the strong light of further discoveries.

The ceramic remains indicate that the site was at least visited by representatives of four different aboriginal cultural groups through a time span of several centuries. Although negative evidence must be used with caution in the initial stages of an excavation, the total lack of any sign of permanent dwellings indicates that the occupations were of a temporary nature, with shelters which would leave no archeological trace or possibly

none at all. The occurrence of pottery of such temporally separate peoples as Woodland and Dismal River (or their Puebloan contemporaries) plus the wide variety of pottery assignable to the Upper Republican aspect indicates that Coal-oil canyon was known to the aboriginal occupants of the Central Plains for eight or nine centuries. And the probability that RV 3 and V 26 belong to the historic Pawnee broadens both the temporal and spatial ranges. Present evidence seems to indicate a number of temporary occupations — possibly recurring — by small groups of people. The reasons for such occupations in a region generally considered climatically inhospitable to the horticultural economy of pottery-making peoples are purely conjectural at present, though some possibilities have been suggested during the preliminary testing.

Sites in the semi-arid High Plains which produce small amounts of pottery but no evidence of permanent dwellings are usually considered to be hunting camps temporarily occupied by parties hunting game or otherwise adventuring from their home villages located in areas more favorable to horticulture. The occurrence of unusually large numbers of arrowpoints as well as numerous knives and scrapers at 14L01 might indicate a "meat camp." But the necessity — not to mention the practical value — of "making meat" at a considerable distance (for pedestrian hunters) from the home village seems open to question. The proto-historic and early historic Plains peoples, such as the Pawnee, with a population heavily concentrated in a small area, were forced by the rapid depletion of game in the vicinity of the villages to hunt increasingly farther from home. But it seems unlikely that the earlier semi-sedentary Upper Republican peoples, a smaller and more scattered population to judge by their village remains, would travel scores or hundreds of miles on foot solely for the purpose of obtaining meat.

While the evidence to date indicates that the occupations were not of a permanent nature, the amounts of pottery suggest that they were of more than a few days duration. Some of the vessels show signs of considerable use. It might be argued that the pottery could have been carried to the site and broken or abandoned there. Two or three pots are made of material foreign to the locality and undoubtedly were imported. But there is strong evidence that many, probably the majority, of the pots were made of materials available within a few hundred yards of the site and therefore were most likely made there.

The use of pottery also seems to imply a source of water more reliable than occurs in the canyon today. The probability of a spring, as mentioned in the section on local environment, cannot be demonstrated as yet but remains a possibility. For the Plains Woodland people, who seem to have been small groups of hardy semi-nomads, a large spring might have

been sufficient incentive to settle for a time. But if the upland water table was high enough to produce spring water in Coal-oil Canyon there would undoubtedly have been springs in many of the canyons to the west and the river, only a few miles distant, would have been a larger stream than it is today. So even a large reliable source of water could not be considered a sufficient attraction to entirely account for the occupations at the site.

Another possible attraction, one which needs to be more fully studied, is the occurrence near the site of the red and yellow ochers. This material for the most part is soft enough to be used for paint with little or no preparation and would undoubtedly have been of value to the aborigines of the area. I have no idea at present how common, or rare, deposits of such pigment materials might be throughout the Central Plains. Iron oxide is abundant in various forms in most beds of the widespread Pierre formation. In western Kansas yellow and (rarely) red ochers of varying degrees of purity and hardness occur as seams along the bedding planes of the shale. Ordinarily these seams, particularly of the reddest material, are so thin as to make collection of appreciable amounts very difficult or impossible, but it is no doubt possible that thicker veins of pure ochers were formed in places.

As far as we know there are only two localities in Wallace and Logan Counties where the ochers are concentrated in collectable amounts, in the limey concretions mentioned in the section on geology. One of these is located within a few hundred yards of the site, the other about a mile northwest in an adjoining canyon. In neither of the localities can the ocher be considered inordinately abundant at present; at the Coal-oil bed it would require considerable time and effort to gather one hundred pounds of usable material. Whether or not it was formerly more plentiful and has been mined out by the Indians is difficult to guess. The concretions appear on the surface as the softer shale is eroded from around them; they are scattered, some contain ocher, some do not and not all the ocher is pure enough for use.

The numerous pieces of ocher found with the cultural material at the site indicate considerable interest in the material on the part of the occupants. Probably there is more red ocher to be found in the site debris than occurs in the natural deposits at present. This apparent carelessness with the material tends to cast some doubt on the value it had to the occupants. On the other hand it might be an indication that the ocher was considered super-abundant — a parallel to our own reckless depletion of natural resources. But whether natural deposits of pigment material were so rare on the Plains that prehistoric people would travel long distances to obtain it is a question requiring further study.

For whatever reason, Coal-oil Canyon seems to have been a favored prehistoric camp site in a region where definitive archeological sites are relatively uncommon and few have been studied. As with any sparsely-occupied multi-component site, its main anthropoligical value would probably be in stratigraphy and this does not appear too promising in most Areas. The tests indicate that erosion and redeposition have mixed materials and obscured stratigraphy over much of the site. And the Areas, such as Area 7, which seem to have the deepest and least-disturbed stratification seem also to have the least diagnostic cultural material. But, while much valuable information has been lost at the site there is reason to hope that much still remains. In one deep test traces of human occupations were found at depths well below the Woodland level. The temporal sequence from Woodland through Dismal River has been demonstrated at other sites and 14L01 might add something to this information. Some temporal variation might be found within the Upper Republican aspect itself, and the location of the site makes it reasonable to hope for evidence of Plains-Pueblo contact which could provide some valuable cross-dating. The site, in short, has possibilities, but many tons of dirt and rock must be moved before its full value can be determined.

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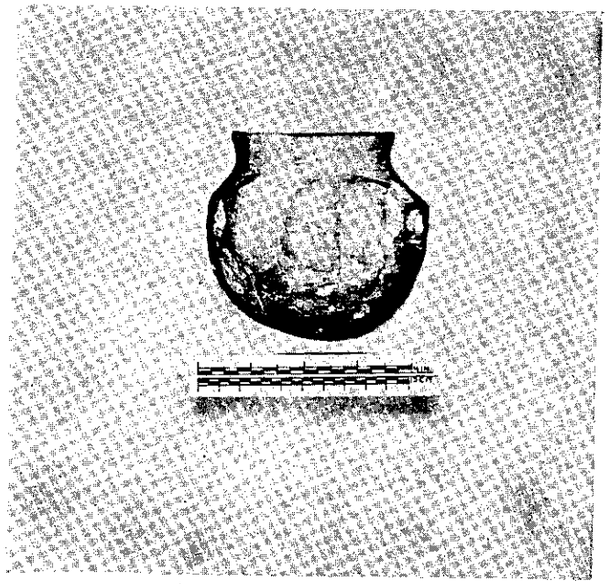
PLATE 1a

PLATE 1b

PLATE 2.

PLATE 3.



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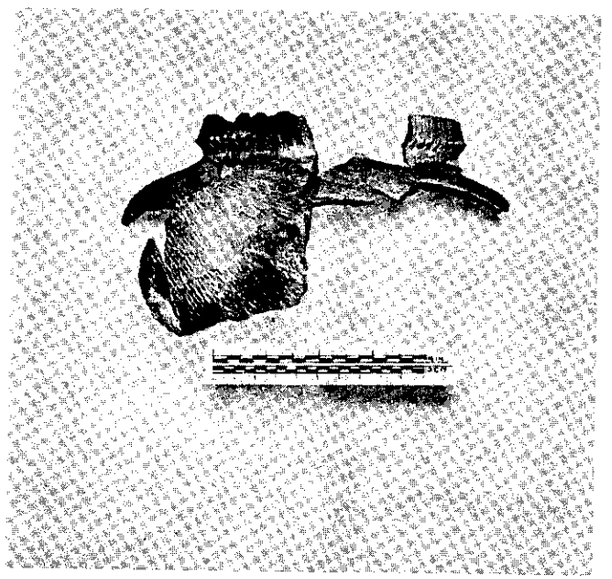

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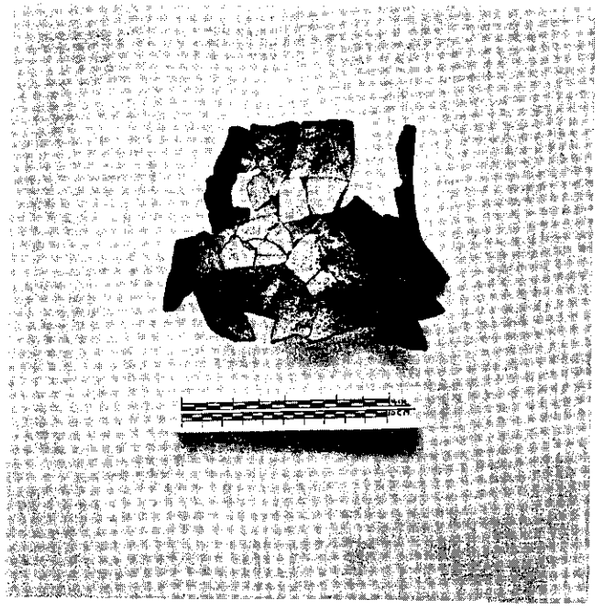

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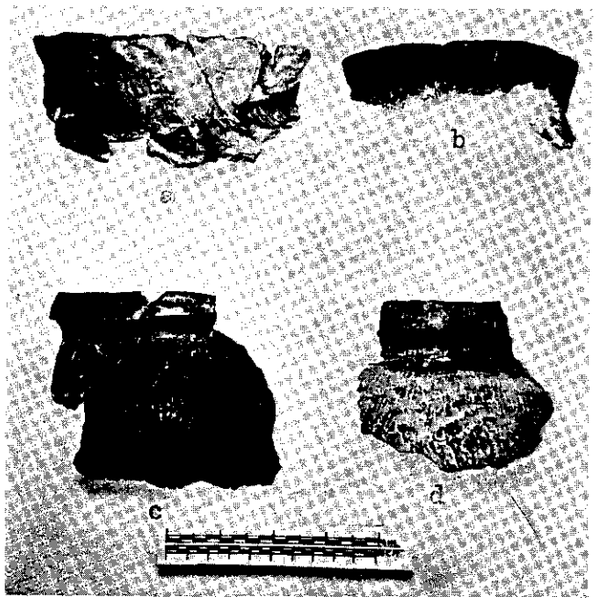

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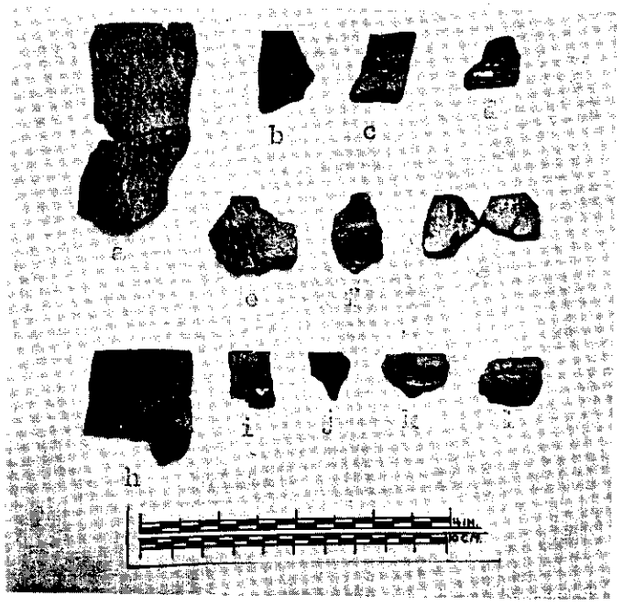


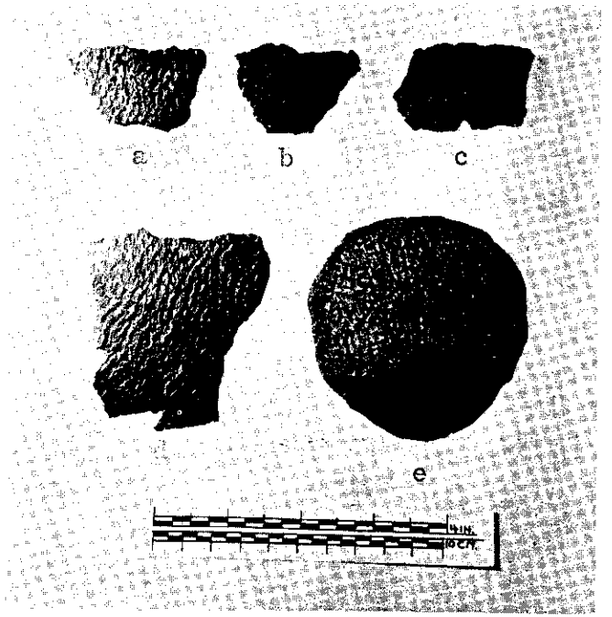
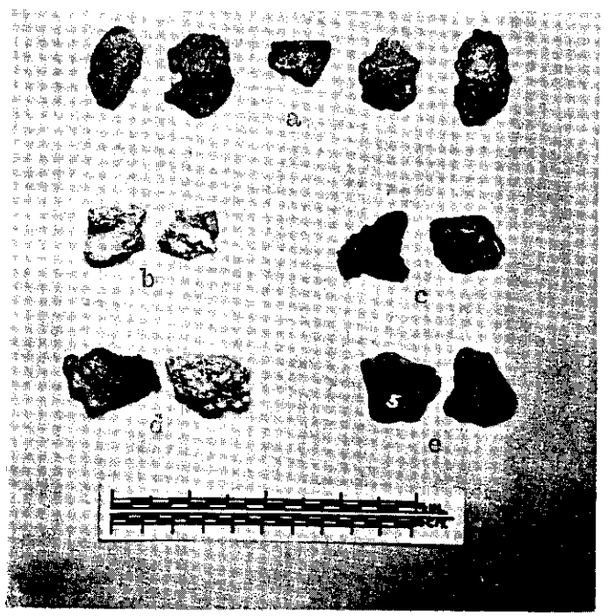
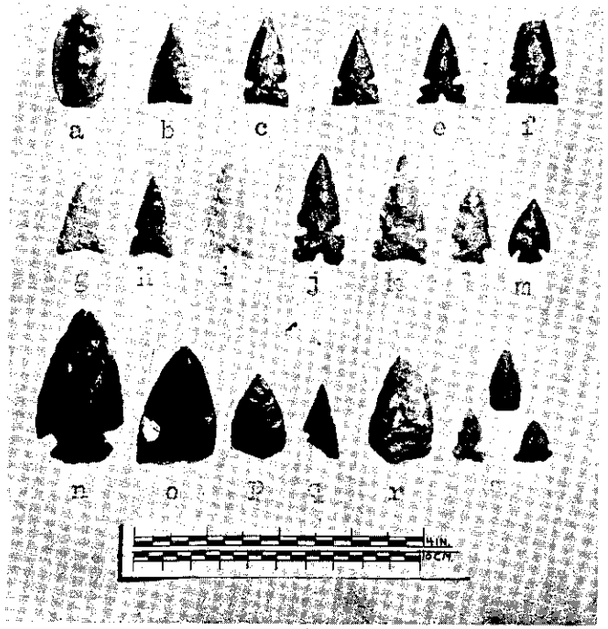


PLATE 10.





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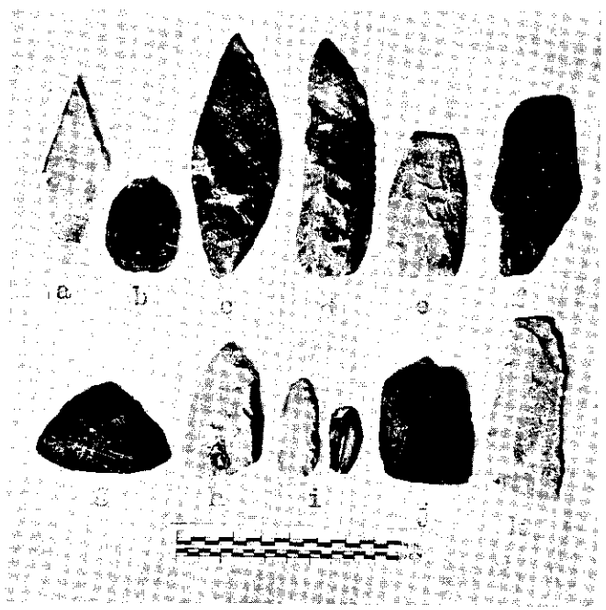


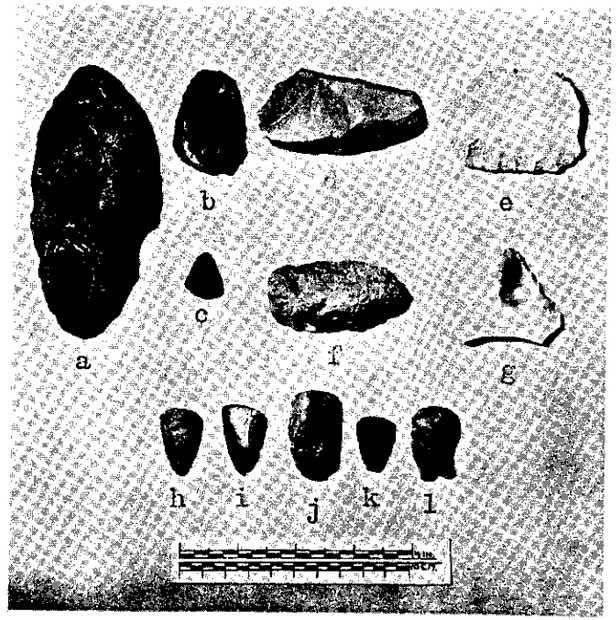
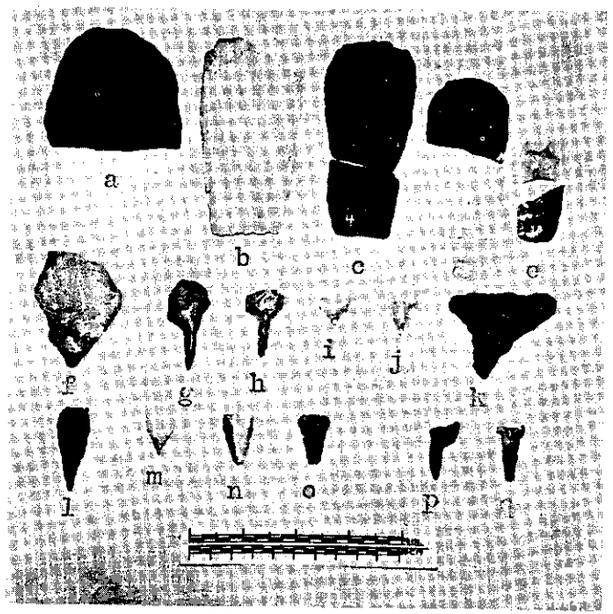


PLATE 14.



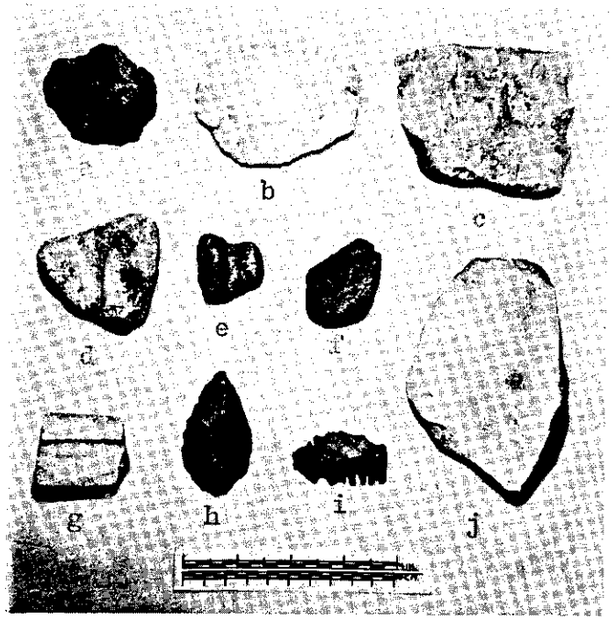


PLATE 16.

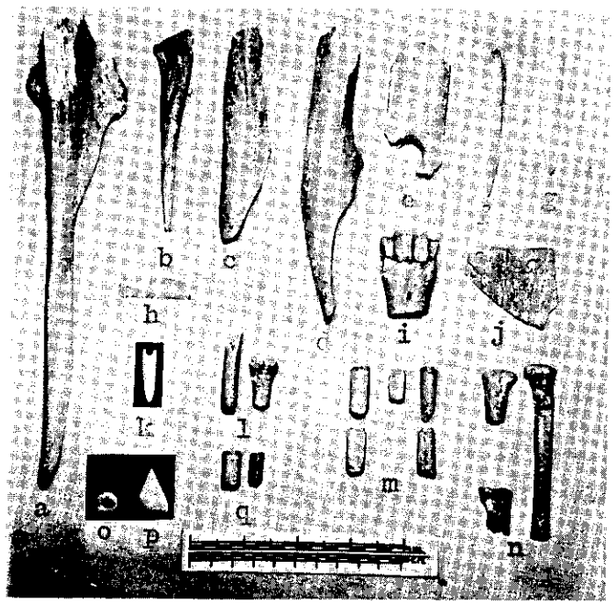


PLATE 17.